**POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAMME**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **First Year** | | | | | | |
| **I. Semester** | | | | | | |
| Code | Course Title | ECTS | T+P | Credit | C/E | Language |
| 501011101 | [THE SCIENTIFIC RESEARCH METHODS AND ITS ETHICS](#EN31) | 7.5 | 3+0 | 3 | **C** | Turkish |
| 505401501 | [FUNDAMENTALS OF POLYMER CHEMISTRY](#EN1) | 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 |
| 505402501 | [POLYMER CHARACTERIZATION](#EN2) | 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 |
| 505402001 | 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 |
| 505401702 | MSc THESIS STUDY | | 25 | | 0+1 | - | **C** | Turkish |
| 505401703 | 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 | |
| 505401702 | | MSc THESIS STUDY | 25 | 0+1 | | - | **C** | Turkish | |
| 505401703 | | 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 |
| 505401502 | [METHODS IN POLYMER SYNTHESIS](#EN16) | 7.5 | 3+0 | 3 | E | Turkish |
| 505401503 | [POLYMER ENGINEERING](#EN21) | 7.5 | 3+0 | 3 | E | Turkish |
| 505401504 | [POLYMER RHELOGY](#EN26) | 7.5 | 3+0 | 3 | E | Turkish |
| 505401505 | [POLYMER PROCESSING](#EN24) | 7.5 | 3+0 | 3 | E | Turkish |
| 505401506 | [POLYMERS IN CORROSION CONTROL](#EN27) | 7.5 | 3+0 | 3 | E | Turkish |
| 505401507 | [INDUSTRIAL POLYMERS](#EN11) | 7.5 | 3+0 | 3 | E | Turkish |
| 505401508 | [INDUSTRIAL ADHESIVES](#EN10) | 7.5 | 3+0 | 3 | E | Turkish |
| 505402502 | [LIVING POLYMERIZATION CHEMISTRY](#EN13) | 7.5 | 3+0 | 3 | E | Turkish |
| 505402503 | [HETEROGENEOUS POLYMERIZATION SYSTEMS](#EN9) | 7.5 | 3+0 | 3 | E | Turkish |
| 505402504 | [STABILITY AND DEGRADATION OF POLYMERS](#EN28) | 7.5 | 3+0 | 3 | E | Turkish |
| 505402505 | [POLYMER RECYCLING TECHNOLOGIES](#EN25) | 7.5 | 3+0 | 3 | E | Turkish |
| 505402506 | [CONDUCTING POLYMERS](#EN6) | 7.5 | 3+0 | 3 | E | Turkish |
| 505402507 | [BIOPOLYMERS](#EN4) | 7.5 | 3+0 | 3 | E | Turkish |
| 505402508 | [INORGANIC POLYMERS](#EN12) | 7.5 | 3+0 | 3 | E | Turkish |

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505401501 | **TITLE** | Fundamentals of Polymer Chemistry |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| x | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction, definitions, nomenclature and uses of polymers, tacticity, polymer structure and classification, molecular weights, the physical properties of polymers, crystallization, Dc, Tm and Tg, viscosity, step-growth polymerization, free radical polymerization, anionic polymerization, cationic polymerization, Zeigler-Natta polymerization, ring opening polymerization, copolymerization and copolymers, other polymerization techniques: Mass, solvents, dispersion, suspension, emulsion polymerizations. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To understand the meaning and importance of polymers that holds an important place in our daily live. To gain experience on the design, synthesis and characterization of polymeric materials.  Having information about the properties and applications of polymers.  To train of individuals equipped with sufficient polymer chemistry in accordance with the needs of the sector. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To contribute individuals who have knowledge about polymer science and technology | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Recognize a wide range of polymers  2. Calculate mol weight tand comprehend the importance of MOL weights,  3.Define the properties of polymers in the solid state,  4.Understand the kinetics of both chain polymerization and step-growth polymerisations.  5. Makes a comparison between anionic and free radical polymerization,  6. Define and illustrate Zeigler-Natta and cationic polymerisations  7. distinguishes between bulk, solution and precipitation polymerizations | | | | | | | |
| **TEXTBOOK** | | | | | Polimer Kimyası (M. Saçak, Gazi yayınları) | | | | | | | |
| **OTHER REFERENCES** | | | | | Textbook of Polymer Science (Billmeyer)Polymers:Chemistry and Physics of Modern Materials (JMG Cowie-1991)Principles of Polymerisation (Odian) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction, definitions, nomenclature, |
| 2 | polymer structure and classification, |
| 3 | polymer areas, taktisite, molecular weights, |
| 4 | Physical properties of polymers, crystallization, DC, Tm and Tg, |
| 5 | viscosity, |
| 6 | Midterm Examination 1 |
| 7 | Stepwise polymerization, free radical polymerization, |
| 8 | Anionic polymerization, cationic polymerization, |
| 9 | Zeigler-Natta polymerization, ring opening polymerization |
| 10 | Copolymerization and copolymers |
| 11 | Midterm Examination 2 |
| 12 | Other technological polymerization techniques: mass and solution polymerizations. |
| 13 | Other technological polymerization techniques: Dispersion, suspension polymerizations. |
| 14 | Other technological polymerization techniques: Emulsion polymerization. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Vural Bütün **Date:**  02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| --- | --- | --- | --- |
| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505402501 | **TITLE** | Polymer Characterization |

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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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | An overview of polymer characterization methods.  Purification: Precipitation, vacuum drying, rotary evaporator, freeze dryer, extraction. Methods of molecular weight determination: Gel permeation chromatography, colligative properties, viscosity measurements, end-group analysis H NMR spectroscopy. To determine the Mw using X-Ray, SANS, SAXS, static light scattering. The other spectroscopic methods: IR, FT-IR, UV-vis. Proton and C-13 NMR structure analysis-kinetic working principles. Thermal Characterizations: DTA, DSC, TGA. Zeta potentiometer, surface tension, densimeter. To determine the hydrodynamic properties of polymers using in liquid media DLS method. Polymer morphology, the glass transition temperature and the degree of crystal. Conformational Analysis of Polymers. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To learn the methods that can be used to provide structure elucidation of polymers. Ensure that students face in the industry to gain familiarity with the device and methods and to facilitate adaptation to the sector. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Pre-recognition devices are widely used in industry: GPC, X-ray, IR, UV, proton and carbon-13 NMR. If you need to have prior knowledge of the use of these devices to be in business. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Polymer molecular weights and measurement principles can assess which methods and devices know.  2. Determination of structures of polymers diffraction, scattering, thermal and spectroscopic methods will have to use the equipment.  3. Morphology of polymers, glass transition temperature and the degree of crystal can identify and conformational analysis. | | | | | | | |
| **TEXTBOOK** | | | | | 1. Polymer Chemistry A Practical Aproach”, Ed. F. J. Davis, Oxford University Pres. UK-2004 | | | | | | | |
| **OTHER REFERENCES** | | | | | 2. Light Scattering from Polymer Solutions and Nanoparticle Dispersions”, W. Schartl, Germany, Springer-Verlag Berlin Heidelberg 20073. “NMR Spect. and Polymer Microstruct”, A. E. Tonelli, VCH Publishers, Inc, 19894. Polymers: Chem and Phy of Modern Materials”, J.M.G. Cowie, 2nd Ed. 1991, UK5. Contemporary Polymer Chemistry”, H.R. Allcock, F.W. lampe, J. E. Mark, 3rd ed. 2003, New Jersey - USA | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | An overview of the methods of polymer characterization |
| 2 | Polymer purification: Precipitation, vacuum drying, rotary evaporator, freeze dryer, extraction |
| 3 | Methods of molecular weight determination: Gel permeation chromatography (GPC) |
| 4 | Molecular weight determination methods: Colligative properties, viscosity measurements |
| 5 | Molecular weight determination methods: End-group analysis, proton NMR spectroscopy |
| 6 | Midterm Examination 1 |
| 7 | To determine the Mw using X-Ray, SANS, SAXS, static light scattering |
| 8 | The other spectroscopic methods: IR, FT-IR, UV-vis |
| 9 | Proton and carbon-13 NMR structure analysis-kinetic working principles |
| 10 | Thermal Characterizations: DTA, DSC, TGA |
| 11 | Midterm Examination 2 |
| 12 | Zeta potentiometer, surface tension, densimeter |
| 13 | To determine the hydrodynamic properties of polymers using in liquid media DLS method. |
| 14 | Polymer morphology, the glass transition temperature and the degree of crystal, Conformational Analysis of Polymers |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Vural Bütün **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505402507 | **TITLE** | Biopolymers |

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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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 25 |
| Quiz | | | | | 1 | | 25 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Potential producers of polymers for the production of microbial properties of the course will be described. Microbial properties of polymer production mediums and production techniques will be discussed in detail. The medium of production of biopolymers can be used to obtain the described techniques. These poly hydroxy butyrate production techniques and production methods and the hyaluronic acid production and extraction as a model by applying explained. The differences between bacterial and fungal polymers and their uses will be discussed. Biocompatibility testing methods used in the investigation of the antimicrobial activity of biopolymers in practice will be described. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The course of biopolymers chemistry, physics, biology and engineering, and their all important aspects related to biotechnology and biomedical applications of theoretical lectures, practice, discussions and presentations explaining and aims to teach. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | This course will contribute students to produce polymers using a variety of microorganisms. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1."Biopolymer" and general materials should be covered by the definition to describe the difference,  2. What type of biopolymers used in biology and medicine, and it is important to learn which specific features,  3. Explain the interactions between the biopolymer and the tissue,  4. Learn how to nano-scale will be modified according to the desired purpose of biopolymer,  5. Explain applications of nano structure of biopolymers, | | | | | | | |
| **TEXTBOOK** | | | | | R.M. Johnson, L.Y. Mwaikambo and N. Tucker, Biopolymers, Shrewsbury, U.K. : Rapra Technology, 2003 | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Ratner B. D., Hoffman A. S., Schoen F. J. Lemons J. E., Biomaterials Sci: An Intr. to Materials in Medicine, 2nd edn. Elsevier Acad Press, 2004.2. Hari Singh Nalwa, “Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology”, American Scientific Publishers, 2005.3. Rehm, B.H.A., Microbial Bionanotechnology, hofizon bioscience, 20064. Steinbüchel A., Marchessault R.H., Biopolymers for Medical and Pharmaceutical applications, Wiley ICH, 20055. Rehm B.H.A., Microbial production of Biopolymers and polymer precursor, Caister Academic Press, 2009. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Polymer producer microorganisms, bacteria |
| 2 | Polymer producer microorganisms, Fungi |
| 3 | Polymer producer microorganisms, Algae |
| 4 | Biodegradability, Environmental importance |
| 5 | Economic impact of biopolymers, market share |
| 6 | Midterm Examination 1 |
| 7 | Biopolymer synthesis, cellulose, hemicelluloses, starch |
| 8 | Biopolymer synthesis, polyhydroxyalchonate, tannin |
| 9 | Biopolymer synthesis, polyactic acid, lignin |
| 10 | Biopolymers that are available commercially |
| 11 | Midterm Examination 2 |
| 12 | Areas of Biopolymers |
| 13 | Pharmaceutical biopolymers |
| 14 | Production from waste biopolymers |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Ahmet ÇABUK **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505402506 | **TITLE** | Conducting 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 | | | | | 1 | | 50 |
| Quiz | | | | |  | |  |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Conductive polymer identification, theory of conductivity of conductive polymers, conductive polymers, applications, methods of synthesis of conductive polymers, conductive polymers, polymerization mechanisms, and applications of conductive polymers | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course to teach synthesis of conducting polymers and its some of applications. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students will have the ability to interpret the industrial area will need. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Define the conducting polymers, describe the general synthesis methods of conducting polymers, learn the polymerization mechanism of conducting polymer, gain knowledge about synthesis conducting polymers using electrochemical methods, learn some of applications obtained conducting polymers. | | | | | | | |
| **TEXTBOOK** | | | | | Conductive Electroactive Polymers: Intelligent Polymer Systems, Gordon G. Wallace, Geoffrey M. Spinks, Leon A. P. Kane-Maguire, and Peter R. Teasdale | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Thesis about conducting polymers.2. Journals related with conducting polymer and its applications.3. Conductive Polymers and Plastics: In Industrial Applications, Larry Rup | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Basis of conducting polymers |
| 2 | Conductivity properties |
| 3 | Doping reactions |
| 4 | Doped by itself conducting polymer |
| 5 | Semi-conductive models for conducting polymers |
| 6 | Midterm Examination 1 |
| 7 | Electrochromic properties |
| 8 | Solibility and workability of conducting polymers |
| 9 | Characterization methods |
| 10 | Characterization methods |
| 11 | Midterm Examination 2 |
| 12 | Sensor applications of conducting polymers |
| 13 | Solar cell applications of conducting polymers |
| 14 | Supercapacitor applications of conducting polymers |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Assoc. Prof. Evrim HÜR **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505402503 | **TITLE** | Heterogeneous Polymerization Systems |

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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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Overview of polymer hydrodynamics. Diffusion in solution. Sedimentation in solution. The solution viscosity. Polyelectrolyte. Multi-component systems containing macromolecules. Heterogeneous polymerization systems. Surface active agents. Emulsifying agents. Stabilizers. Emulsion polymerization techniques, types of emulsions. Mechanism of emulsion polymerization. Kinetics of emulsion polymerization. Suspension polymerization, dispersion polymerization. Industrial applications of heterogeneous polymerization systems. Industrial heterogeneous polymers. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To understand the meaning and importance of the heterogeneous polymerization systems, to introduce and illustrate the concepts of polyelectrolyte and surfactant, to give detailed information about emulsion, suspension and dispersion polymerization techniques. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | The basics and applications of heterogeneous polymerization techniques which are widely used in industry will be learned. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Define the concept of heterogeneous polymerization system,  2. Explain emulsion, suspension and dispersion polymerization techniques, 3. Exemplify applications of heterogeneous polymer systems. | | | | | | | |
| **TEXTBOOK** | | | | | V.T. Liveri, Controlled Synthesis of Nanoparticles in Microheterogeneous Systems, Springer, 2006. | | | | | | | |
| **OTHER REFERENCES** | | | | | H.Y. Erbil, Vinyl Acetate Emulsion Polymerization and Copolymerization with Acrylic Monomers, CRC Press, 2000. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Overview of polymer hydrodynamics |
| 2 | Diffusion in solution and sedimentation in solution |
| 3 | The solution viscosity, polyelectrolyte |
| 4 | Multi-component systems containing macromolecules |
| 5 | Heterogeneous polymerization systems |
| 6 | Midterm Examination 1 |
| 7 | Surface active agents, emulsifying agents, stabilizers |
| 8 | Emulsion polymerization techniques, types of emulsions |
| 9 | Mechanism of emulsion polymerization |
| 10 | Kinetics of emulsion polymerization |
| 11 | Midterm Examination 2 |
| 12 | Suspension polymerization |
| 13 | Dispersion polymerization |
| 14 | Industrial applications of heterogeneous polymerization systems and industrial heterogeneous polymers |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Doç. Dr. Berrin DURAN **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 5505401508 | **TITLE** | Industrial Adhesives |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | |  | |  |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 50 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The introduction to adhesives, solvents, the classification of adhesives, thermosets, thermoplastic adhesives, elastomers and synthetic elastomers, silicon polymers, natural adhesives, the application of adhesives | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The purpose of this course, students generally provide information about industrial adhesives, adhesive industry, the importance of the understanding of polymeric additives adhesives. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Adhesives business sector will have the basic knowledge needed. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. The classification of adhesives  2.The adhesive materials and their properties  3. The Industrial application of adhesives  4. They learn about the new adhesives in the adhesive industry. | | | | | | | |
| **TEXTBOOK** | | | | | Ana Hatlarıyla Yapıştırıcılar, F. Kaya,2004 Birsen Yayınevi | | | | | | | |
| **OTHER REFERENCES** | | | | | 1..Ana Hatlarıyla Plastikler ve Katkı maddeleri, .F.Kaya,2005 Birsen Yayınevi2. Polimer Kimyası, M.Saçak,2002,Gazi Kitapevi | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The Introduction to Adhesives |
| 2 | Solvents |
| 3 | The Classification of Adhesives |
| 4 | Thermosets |
| 5 | Thermosets |
| 6 | Midterm Examination 1 |
| 7 | Thermoplastic Adhesives |
| 8 | Thermoplastic Adhesives |
| 9 | Elastomers and Synthetic Elastomers |
| 10 | Silicon Polymers |
| 11 | Midterm Examination 2 |
| 12 | Natural Adhesives |
| 13 | Mastics |
| 14 | The application of Adhesives |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Assoc. Prof. Dr. Taner ARSLAN **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505401507 | **TITLE** | Industrial Polymers |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
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| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The historical development of polymers and their classification; the definition of industrial polymers, general properties of polymeric materials, monomer synthesis, industrial polymers, thermoplastics, thermosets, polymer production technologies, foams, additives materrials, recovery | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Understanding the meaning and importance of plastics,  Introducing the world of polymer more closely.  Ability to obtain general information about the acquisition of production-processing processes,  Gaining some common knowledge about polymer properties and application areas  By educating individuals with sufficient knowledge of commercial polymer, it will be easier for them to adapt to the related sectors. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Allows the student to have important knowledge on industrial polymers | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Recognize a wide range of industrial polymers,  2. Know the plastics industry in Turkey  3. Have knowledge about industrial polymers and their uses.  4. Learn about the processes of industrial polymer processing  5. Have knowledge about the processes of fragmentation and recycling of polymers | | | | | | | |
| **TEXTBOOK** | | | | | Ana Hatlarıyla Plastikler ve Katkı maddeleri, F.KAYA,2005 Birsen Yayınevi | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Handbook of Polymer Synthesis, H.R. Kricheldorf, O. Nuyken, G. Swift, 2nd Ed. Marcel Denkel, New York.2.Textbook of polymer science (Billmeyer) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction, preliminary concepts Introduction to Plastics technology |
| 2 | The historical development and classification of polymers, daily and industrial polymers definition, |
| 3 | General properties of polymeric materials, monomers and synthesis; |
| 4 | Industrial polymers,  Thermoplastics (1): polyethylene, polypropylene, polystyrene, styrene copolymers |
| 5 | Thermoplastics (2): ionomers, acrylonitrile-butadiene-styrene, styrene-acrylonitrile |
| 6 | Midterm Examination 1 |
| 7 | Thermoplastics (3): The vinyl plastics: polyvinyl chloride, polyvinyl alcohol, polytetrafluoroethylene |
| 8 | Thermoplastics (4): acrylic polymers, cellulosic polymers, |
| 9 | Thermosets (1): phenolic resins, amino resins, polyesters, epoxy resins, polyurethanes, silicones, polycarbonates polyamides, polyimides ... |
| 10 | Thermosets (2): polyurethanes, silicones, polycarbonates polyamides, polyimides ... |
| 11 | Midterm Examination 2 |
| 12 | Engineering Plastics: Acetals, poliamidimidler, polycarbonates, polyketones |
| 13 | Polymer foam technology: PS, PU, PVC, PP, PE Foam |
| 14 | Plastic additives, Cleaning and recycling of polymers |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Vural Bütün **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505402508 | **TITLE** | Inorganic 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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Definition of inorganic polymers, the structures of inorganic polymers, classification of inorganic polymers according to various aspects, elastomeric inorganic polymers, metal containing polymers, inorganic polymers used as a catalyst, inorganic polymer having luminescence properties and application areas of inorganic polymers. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Understanding the meaning and importance of inorganic polymers which holds an important place in our daily live. More closely to promote the world of inorganic polymer and manufacturing / machining processes to provide general information about the acquisition, some well-known properties of polymers and their applications to ensure that knowledge of the industry can adapt more easily to contribute to the training of personnel. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Recognize the inorganic polymers and provide information about application areas of inorganic polymers. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. The students will learn difference between organic and inorganic polymers  2. The students will understand what kind of materials are appropriate for polymerization  3. The students will learn 1-D, 2-D, 3-D polymeric structure  4. The students will learn metal-containing polymers  5. The students will have idea about application areas of inorganic polymers | | | | | | | |
| **TEXTBOOK** | | | | | James E. Mark, Harry R. Allcock, Robert West, Inorganic Polymers, Prentice Hall, 1992. | | | | | | | |
| **OTHER REFERENCES** | | | | | Ronald D. Archer, Inorganic and Organometallic Polymers, wiley–vch. 2001. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition of inorganic polymers, Special Characteristics of inorganic polymers, Modulus of Elasticity, Tensile Strength and Brittleness |
| 2 | Solubility, Glass Transition Temperature, Chrystallinity, Methods of characterization |
| 3 | Classification of inorganic polymers, History of inorganic polymers, Linear (Two-connective) polymers,polymeric sulphur, polymeric selenium,polymeric tellurium. |
| 4 | Linear polyphosphates(metaphosphates), alkali metal polyphosphates, polyphosphazenes, properties of polyphosphazenes |
| 5 | Polymeric sulphur nitride, polycarboranes, Three-connective network polymers, chalcogenide glasses, binary chalcogenide glasses, multicomponent chalcogenide glasses, |
| 6 | Midterm Examination 1 |
| 7 | Structure of multicomponentchalcogenide glasses, properties, glass transition temperatures, viscoelastic properties, electrical properties, Ultraphosphata glasses, |
| 8 | Preparation of Ultraphosphata glasses, glass transition temperatures, durability, melt viscosity, modulus, surface properties |
| 9 | Boron Nitride, Networks of mixed Three-and four-connectivity, Borate glasses, |
| 10 | Borate glasses, properties, expansion coefficient, Borophosphate glasses, |
| 11 | Midterm Examination 2 |
| 12 | Formation of Borophosphate glasses, structure, properties, glass transition temperature, durability, Melt viscosity, surface properties, |
| 13 | Metal-coordination polymers, inorganic polymer using as catalyst |
| 14 | Luminescence inorganic polymers |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Okan Zafer YEŞİLEL **Date:** 02.04.15

**Signature**

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505402502 | **TITLE** | LİVİNG POLYMERİZATİON CHEMİSTRY |

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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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction, general definitions, overview of condensation and addition polymerizations, living polymerization chemistry, living anionic polymerization, living cationic polymerization, living radical polymerization methods. Group transfer polymerization, atom transfer radical polymerization (ATRP or TMMRP), living oxyanionic polymerization, ROMP, NMRP, RAFT, CCTP. | | | | | | | |
| **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. | | | | | | | |
| **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. | | | | | | | |
| **TEXTBOOK** | | | | | Handbook of Polymer Synthesis, H.R. Kricheldorf, O. Nuyken, G. Swift, 2nd Ed. Marcel Denkel, New York. 2005 Developments in Block Copolymer Science and Technology. Edited by IW Hamley, Wiley Press, UK, 2004. | | | | | | | |
| **OTHER REFERENCES** | | | | | lecture notes, projector. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction, general definitions |
| 2 | Overview of condenzation polymerization |
| 3 | Overview of addition polymerization |
| 4 | Chemistry of living polymerization |
| 5 | Living anionic polymerization |
| 6 | Midterm Examination 1 |
| 7 | Living cationic polymerization |
| 8 | Living radical polymerization |
| 9 | Group transfer polymerization |
| 10 | Atom transfer radical polymerization (ATRP or TMMRP) |
| 11 | Midterm Examination 2 |
| 12 | Living oxyanionic polymerization |
| 13 | ROMP, NMRP |
| 14 | RAFT, CCTP |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Selma YARLIGAN UYSAL **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

|  |  |  |  |
| --- | --- | --- | --- |
| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505401502 | **TITLE** | Methods in Polymer Synthesis |

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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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Introduction and definitions, nomenclature, classification, molar masses of polymers and characterization techniques, stepwise polymerization, radical polymerization of participation, anionic and cationic polymerization, living polymerization techniques. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | To understand the meaning and importance of polymers that holds an important place in our daily live. To gain experience on the design, synthesis and characterization of polymeric materials.  Understanding the issues that should be considered in the areas of commercial application. To educate individuals about the methodology of synthesis of polymers with adequate facilities. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To provide the students having a good background on polymer chemistry | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1.Learn about a wide range of synthesis methods.  2. Choose the appropriate polymerisation method for any monomer  3. Understand the kinetics of both chain polymerization and step-growth polymerisations.  4. Makes a comparison between anionic and free radical polymerization,  5. Define and illustrate Zeigler-Natta and cationic polymerisations  6. distinguishes between bulk, solution and precipitation polymerizations | | | | | | | |
| **TEXTBOOK** | | | | | Polimer Kimyası (M. Saçak, Gazi yayınları) | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Handbook of Polymer Synthesis, H.R. Kricheldorf, O. Nuyken, G. Swift 2nd Ed. Marcel Denkel, New York, 2005. 2. Polymers: Chemistry and Physics of Modern Materials (J.M.G. Cowie), 2nd Ed. Stanley Thornes Inc. 1998, UK 3.Contemporary Polymer Chemistry, HR Allcock, FW Lampe,m JE Mark, 3rd Ed. Pearson Education Inc. USA, 2003 4.Principles of Polymerisation (Odian) 5.Polimer Teknolojisi (M. Saçak) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction, preliminary concepts. Polymer nomenclature and classification |
| 2 | Molar masses of polymers and Polymer Characterization Methods |
| 3 | Stepwise polymerization: monomer types, and their polymer products, condensation reactions and kinetics, degree of polymerization and commercial applications |
| 4 | Free-radical addition polymerization (1): Initiators, chain reactions, inhibitors, retardants, initiator efficiency, the gel effect |
| 5 | The free-radical addition polymerization (2): Chain transfer, radical polymerization kinetics and determination of rate constants, comparison of step-growth polymerisation and addition polymerisations |
| 6 | Midterm Examination 1 |
| 7 | Ionic polymerization (1): The anionic polymerization, initiators, monomers, solvents, reaction mechanism and kinetics. |
| 8 | Ionic polymerization (2): The cationic polymerization, initiators, monomers, solvents, reaction mechanism and kinetics. |
| 9 | Living polymerization techniques: GTP, ATRP, RAFT, Oxyanionic polymerization |
| 10 | Characterization of polymers with different techniques. |
| 11 | Midterm Examination 2 |
| 12 | Living in the potential of polymer synthesis techniques, ionic polymerization commercial applications, |
| 13 | Recently featured polymerization techniques, ATRP and its application |
| 14 | GTP polymerization technique and application |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Vural Bütün **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505401503 | **TITLE** | Polymer Engineering |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Polymer engineering used repetition of principles: Heat transfer, momentum transfer, deformation, rheological equations. Plastic processing mixtures, varieties. Plastics industry used of the test methods, rheometers, optical methods, birefringence. Blow molding, extrusion whit foaming, injection foam. Bonding methods, heat sealing, sealing whit dielectric methods, principles and methods. The engineering principles application to analysis and design in polymerization processes. Mathematical modeling of polymerization kinetics, ideal polymerization reactors, heat and mass transfer, reactor dynamics and optimization, interference effects, examination of important industrial processes. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Ensure that the learning of basic concepts about polymers, polymerization process modeling, ensure that the creation of kinetic models and acquisition of knowledge about the application. The polymerization process learn of heat and momentum transfer. Synthetic structures that are being used in the industry sector in recognition of the need for and provision of training to overcome the elements. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Live information about the individuals who contribute to the growth polymerization techniques. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Synthetic polymers learn  2. Learn about the importance inindustry of synthetic polymers,  3. Learn the usage of synthetic polymers,  4. Modeling of polymerization processes,  5. Desing Models can setting up on the energy and mass balances,  6. To achieve higher efficiency and quality product designs will begin to | | | | | | | |
| **TEXTBOOK** | | | | | 1. Polimerler I (E. Pişkin)2. Mühendislik Polimerleri (E. Pişkin) | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Fundamentals of Polymer Engineering (A. Ram)2. Polymer Process Engineering (Richard G. Griskey) | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Polymer engineering used repetition of principles: Heat transfer, momentum transfer, deformation, rheological equations. |
| 2 | Polymer engineering used repetition of principles: Heat transfer, momentum transfer, deformation, rheological equations. |
| 3 | Plastic processing mixtures, varieties. |
| 4 | Plastics industry used of the test methods, rheometers, optical methods, birefringence. |
| 5 | Blow molding, extrusion whit foaming, injection foam. |
| 6 | Midterm Examination 1 |
| 7 | Bonding methods, heat sealing, sealing whit dielectric methods, |
| 8 | Bonding methods, heat sealing, sealing whit dielectric methods, principles and methods. |
| 9 | The engineering principles application to analysis and design in polymerization processes. |
| 10 | The engineering principles application to analysis and design in polymerization processes. |
| 11 | Midterm Examination 2 |
| 12 | Mathematical modeling of polymerization kinetics, ideal polymerization reactors, heat and mass transfer, |
| 13 | Mathematical modeling of polymerization kinetics, reactor dynamics and optimization |
| 14 | Mathematical modeling of polymerization kinetics,interference effects, examination of important industrial processes. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Selma YARLIGAN UYSAL **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505401505 | **TITLE** | Polymer Processing |

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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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **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** | | | | | Thermoplastic, introduction of thermosets and elastomers, plastics design, general classification of polymer processing methods, introduction of machinery used in extrusion forming operations, examination of extrusion lines one by one, which are important characteristics of polymer extrusion, Examination of current theories of extrusion, extruder operating principle, problems, injection molding and theories, blowing molding, rotate the molding process, the molding process by pouring, the process of creating foam, compression molding, thermoforming and other operations. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Students in our lives introduction of polymeric materials with a wide range of usage, principles and methods of production and processing gain. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Students polymers forming, extrusion, and the current theories and principle of operation in this field will be studied, also have information about other processing methods. For example, injection molding blowing molding, rotating molding, pouring molding, foam generation process, compression molding | | | | | | | |
| **TEXTBOOK** | | | | | 1. Erhan Piskin, Plimer Teknolojisine Giriş, Ankara, offset, Istanbul 19872. Han E. H. Meijer, Processing of Polymers, 1997 | | | | | | | |
| **OTHER REFERENCES** | | | | | Tim A. Osswald, Polymer processing fundamentals, 1998M. Lazar, T. Blaha, J. Rychly, Chemical Reactions of Natural and Synthetic Polymers, Ellis Horwood Limited publishers, UK, 1989. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Thermoplastic, introduction of thermosets and elastomers |
| 2 | Plastics design |
| 3 | General classification of polymer processing methods |
| 4 | Introduction of machinery used in extrusion forming operations |
| 5 | Examination of extrusion lines one by one |
| 6 | Midterm Examination 1 |
| 7 | Which are important characteristics of polymer extrusion |
| 8 | Examination of current theories of extrusion, |
| 9 | Extruder operating principle, problems |
| 10 | Injection molding and theories |
| 11 | Midterm Examination 2 |
| 12 | Blowing molding, rotate the molding process  The molding process by pouring, the process of creating foam |
| 13 | Compression molding |
| 14 | Thermoforming and other operations. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Assist. Prof. Dr. Macit NURBAŞ **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505402505 | **TITLE** | Polymer Recycling Technologies |

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| **LEVEL** | **HOUR/WEEK** | | | | | | **Credit** | **ECTS** | **TYPE** | | | **LANGUAGE** |
| **Theory** | | **Practice** | **Laboratory** | | |
| **MSc** | 3 | |  |  | | | 3 | 7,5 | COMPULSORY  (   ) | | ELECTIVE  ( X ) | Turkish |
| **CREDIT DISTRIBUTION** | | | | | | | | | | | | |
| **Basic Science** | | **Basic Engineering** | | | | **Knowledge in the discipline**  **[if it contains considerable design content, mark with (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | | 1 | | 30 |
| Homework | | | | |  | |  |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The origin and classification of polymer waste, Applied processes as in the evaluation of energy and petrochemical raw materials of polymer waste (pyrolysis gasification, hydrolysis, hydrogenation, liquidation, biological methods), Bio-polymers, methods of chemical conversion of PET  (glycolysis, methanolysis, hydrolysis, hybrid processes, the production of polyol), Recycling of polyolefins, recycling of PVC, recycling of polystyrene, nylon, polyurethane, recycled car tires, the use of polymer waste in activated charcoal manufacture. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | This course gives information about the origin of polymer waste, and this waste is classified and evaluated as a source of energy and petrochemical raw materials are discussed under the applied different methods. In addition, according to the physical properties, chemical structure and area of use of the obtained products, how the evaluated are discussed. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | To contribute to the growth of conscious individuals and effective use of national resources for the recycling and use of plastic. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Able to define and classify the origin of some of the polymers.  2. Polymer to serve as raw material waste energy and petrochemical facilities and processes can be applied for this purpose to define.  3. Polymer waste recycling polymer waste in relation to the processes applied to the evaluation of actual stages of product with simple flow charts to explain.  4. Defining the physical and chemical changes in the flow diagrams.  5. The evaluation of the energy and petrochemical wastes as raw materials in the polymer, the world 'and in Turkey to make comments about the actions being performed | | | | | | | |
| **TEXTBOOK** | | | | |  | | | | | | | |
| **OTHER REFERENCES** | | | | | Recycling Handbuch (Strategien-Techn-Produkte). Werner Nickel,VDI Verlag, 19962. Plastic, Rubber and Paper Recycling, Charles P. Rader ACS Symposium Series 609, 1995 3. Polymer Recycling, John Scheirs, 1997 4. Frontiers in Science and Technology of Polymer Recycling, NATO-ASI Series, Vol.351, Series:E | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction, definitions |
| 2 | The origin and classification of polymer waste, |
| 3 | Applied processes as in the evaluation of energy and petrochemical raw materials of polymer waste: (1) pyrolysis gasification, |
| 4 | Applied processes as in the evaluation of energy and petrochemical raw materials of polymer waste: (2) hydrolysis, hydrogenation, |
| 5 | Applied processes as in the evaluation of energy and petrochemical raw materials of polymer waste: (3) liquidation, biological methods, |
| 6 | Midterm Examination 1 |
| 7 | Bio-polymers, methods of chemical conversion of PET  glycolysis, methanolysis, |
| 8 | Bio-polymers, methods of chemical conversion of PET  hydrolysis, hybrid processes, the production of polyol |
| 9 | Recycling of polyolefins, |
| 10 | Recycling of PVC |
| 11 | Midterm Examination 2 |
| 12 | Recycling of polystyrene |
| 13 | Nylon, polyurethane, recycled car tires, |
| 14 | The use of polymer waste in activated charcoal manufacture. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Muammer Kaya **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505401504 | **TITLE** | Polymer Rhelogy |

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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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 20 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 50 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | The basic concepts of rheology (the bases of flow behavior, measurement methods, mathematical modeling of rheologic behavior), examples of polymer systems, rheometry and material functions, generalized Newton Law models, linear and non-linear viscoelastic models, the rheologic behaviors of polymer liquids in polymer production (the characterization of fluid, industrial rheometers), practical applications of rheology in polymer industry. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Providing the students to gain thorough knowledge about the basis of rheology, rheometry and measurement methods, examining the rheologic behaviors of polymers and mathematical modeling and the applications of polymer rheology. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Students will be able to learn the science of rheology and the necessities to apply it to the real systems, explain the flow behavior of polymer included systems and improve the written and oral communication skills by doing and presenting the homework. | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. Explains the rheology concept, says the differences/similarities of flow behaviors,  2. Explains the rheologic properties of polymers, says the measurement methods,  3. Explains the flow models of non-Newtonian fluids,  4. Examines and evaluates the mathemathical modeling of a system used in polymer rheology. | | | | | | | |
| **TEXTBOOK** | | | | | Bird, R. B., Stewart, W. E., and Lightfoot, E. N., “Transport Phenomena”, 2nd edition, John Wiley, New York, 2002. | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Shenoy, A.V.,“Rheology of filled polymer systems”,Knovel corp., 1999.2. Gupta, R.K., “Polymer and composite rheology”, Marcel Dekker, 2000. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | The basic concepts of rheology |
| 2 | Mathematical modeling of rheologic behavior |
| 3 | Mathematical modeling of rheologic behavior |
| 4 | Examples of the polymer systems |
| 5 | Rheometry and material functions |
| 6 | Midterm Examination 1 |
| 7 | Generalized Newton Law models |
| 8 | Linear and non-linear viscoelastic models |
| 9 | The rheologic behaviors of polymer fluids in polymer production (the characterization of fluid) |
| 10 | The rheologic behaviors of polymer fluids in polymer production (industrial rheometers) |
| 11 | Midterm Examination 2 |
| 12 | Practical applications of rheology in polymer industry |
| 13 | Practical applications of rheology in polymer industry |
| 14 | Homework presentations |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Assist Prof. Dr. Demet Topaloğlu Yazıcı **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505401506 | **TITLE** | Polymers in Corrosion Control |

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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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **ASSESSMENT CRITERIA** | | | | | | | | | | | | |
| **SEMESTER ACTIVITIES** | | | | | **Evaluation Type** | | | | | **Number** | | **Contribution**  **( % )** |
| Midterm | | | | | 1 | | 30 |
| Quiz | | | | |  | |  |
| Homework | | | | | 1 | | 30 |
| Project | | | | |  | |  |
| Report | | | | |  | |  |
| Seminar | | | | |  | |  |
| Other (………) | | | | |  | |  |
| **Final Examination** | | | | | | | 40 |
| **PREREQUISITE(S)** | | | | |  | | | | | | | |
| **SHORT COURSE CONTENT** | | | | | Corrosion definition, electrochemical and thermodynamic aspect, methods for corrosionmeasurements and inhibition, corrosion inhibition by surface coating, preparation of metalsurface, application methods, metallic coating, polymeric coating, physical vapor deposition,electroactive organic polymers, recent applications, some test methods | | | | | | | |
| **COURSE OBJECTIVES** | | | | | The aim of this course is;  1. To give sufficient knowledge and skill about the usage of polymericic materials in corrosion control  2. To contribute positive effects in the needs in this area | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | | Responds to the needs of trained persons in the subject of solving corrosion problems of the industry. Educate these persons in the subject of polymeric coating which is one ofthe corrosion control method | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | 1. To have idea about definition importance and economic aspects of corrosion and also electrochemistry and thermodynamicof corrosion  2. Revise corrosion principles corrosion prevention and control engineering methods  3.Learning corrosion monitoring and test methods  4. Examining protective polymer coatings and polymeric inhibitors | | | | | | | |
| **TEXTBOOK** | | | | | Van, O. (2004). Corrosion Control of Metals by Organic Coatings. UK: CRC | | | | | | | |
| **OTHER REFERENCES** | | | | | 1. Zarras, P. & Stenger-Smith, J.D. & Wei, Y. (2003). Electroactive Polymers forCorrosion Control. Washington, DC: Am Chem Soc.2. Wicks, Z.W. & Jones, F. & Pappas, S.P. (1999). Org Coatings (2nd ed).New York: Wiley.3. Licari, J. J. & Hughes, L. A. (1990). Handbook of Polymer Coatings for4. Electronics – Chemistry, Technology and Applications (2nd ed). Park Ridge, N.J. Noyes Publications.5. Sherier, L. L. & Jarman, R. A. & Burstein, G. T. (1994). Corrosion (3rd ed). Oxford: Butterworth – Heinemann Ltd. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Definition of Corrosion and Electrochemical Nature of Corrosion |
| 2 | Electrochemical Kinetic Approach es in Corrosion |
| 3 | Corrosion Rate Measurment Techniques |
| 4 | Principles and Clasification of Corrosion Protection Techniques |
| 5 | Principles of usin Polymers as Corrosion Inhibitors |
| 6 | Midterm Examination 1 |
| 7 | Usage of water soluble and nonionic polymers as corrosion inhibitors |
| 8 | Principles of Corrosion Protection by Coating |
| 9 | Surface Preparation Metods of Metals for Coating Process |
| 10 | Coating of Metal Surface by polymers by Deep Coating and Spin Coating Methods |
| 11 | Midterm Examination 2 |
| 12 | Coating Metal Surfaces by Nonconducting polymers using Electrochemical Methods |
| 13 | Coating Metal Surfaces By Conducting Polymers using Electrochemical Methods |
| 14 | Recent Advances in Polymer Coatings, Test Methods Related with the Protection Perfomance of Polymer Coatings |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Gözen Bereket **Date:** 02.04.15

**Signature**:

**T.R.**

**ESKISEHIR OSMANGAZI UNIVERSITY**

**GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES**

**COURSE INFORMATION FORM**

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| **DEPARTMENT** | **POLYMER SCIENCE AND TECHNOLOGY (MSc)** | **SEMESTER** |  |

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| **COURSE** | | | |
| **CODE** | 505402504 | **TITLE** | Stability and Degradation of 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 (√)]** | | | | | | |
| 0 | |  | | | |  | | | | | | |
| **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** | | | | | 1. Introduction and general information. Durability of polymers, biodegradable polymers, polymers, recovery, and basic concepts.  2. Based on analysis techniques use to study for mechanisms of degradation of polymers.  3. Thermal degradation, oxidation, photo-degradation mechanisms. Antioxidants and stabilizers.  4. Degradation mechanisms of connections with the danger of fire.  5. Causes and mechanisms of degradation of polymer material is exposed to working conditions, biodegradability and mechanical degradation mechanisms of polymers. | | | | | | | |
| **COURSE OBJECTIVES** | | | | | Students, use of polymeric materials that have wide application area in our lives and provide us with information about the production techniques also be gained during and after the production of this polymer decomposition methods to teach about the property and stability. | | | | | | | |
| **COURSE CONTRIBUTION TO THE PROFESSIONAL EDUCATION** | | | | |  | | | | | | | |
| **LEARNING OUTCOMES OF THE COURSE** | | | | | Durability at polymers recovery and degradability and degradation of polymers will have knowledge about their mechanisms. | | | | | | | |
| **TEXTBOOK** | | | | | Krzysztof Pielichowski, James Njuguna, Thermal degradation of polymeric materials, 2005 | | | | | | | |
| **OTHER REFERENCES** | | | | | lecture notes, projector. | | | | | | | |

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| **COURSE SCHEDULE (Weekly)** | |
| **WEEK** | **TOPICS** |
| 1 | Introduction and general information. |
| 2 | Basic concepts about the durability of polymers. |
| 3 | Basic concepts about recycling of polymers. |
| 4 | Basic concepts of biodegradable polymers. |
| 5 | Based on analysis techniques use to study for mechanisms of degradation of polymers. |
| 6 | Midterm Examination 1 |
| 7 | Thermal degradation, oxidation mechanisms of polymers. |
| 8 | Photo-degradation mechanisms of polymers. |
| 9 | Antioxidants and stabilizers. |
| 10 | Degradation mechanisms of connections with the danger of fire. |
| 11 | Midterm Examination 2 |
| 12 | Causes of degradation of polymer material is exposed to working conditions.  Polymer material is exposed to working conditions, degradation mechanisms. |
| 13 | Biodegradability polymers. |
| 14 | Biodegradability and mechanical degradation mechanisms of polymers. |
| 15,16 | Final Examination |

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| **CONTRIBUTION OF THE COURSE LEARNING OUTCOMES TO THE POLYMER SCIENCE AND TECHNOLOGY MSc PROGRAM LEARNING OUTCOMES** | | **CONTRIBUTION LEVEL** | | |
| **NO** | **LEARNING OUTCOMES (MSc)** | **3**  High | **2**  Mid | **1**  Low |
| **LO 1** | By doing effective literature search and research in the field of polymer science and technology, to gain ability to reach and evaluate the knowledge deeply and widely and to gain the ability to interpret and apply. |  |  |  |
| **LO 2** | Detailed knowledge about the latest techniques and methods applied in PBT field and having extensive knowledge about their limitations. |  |  |  |
| **LO 3** | Ability to develop new and/or original ideas and methods; capability to find or develop innovative/alternative solutions to complex problems encountered during the research process. |  |  |  |
| **LO 4** | Ability to design and practice theoretical, experimental and simulative research tasks and to assess and analyze complex problems that are faces during the research process |  |  |  |
| **LO 5** | Ability to understand what they read using a foreign language at a sufficient level and gain oral and written communication skills. |  |  |  |
| **LO 6** | Be familiar with, and partly to gain the ability to use advanced technology featured in PBT field |  |  |  |
| **LO 7** | Ability to identify and formulate Polymer Science and Technology related problems and in order to solve these problems, to gain the necessary practical skills to develop novel methods and apply innovative alternatives. |  |  |  |
| **LO 8** | Ability to express or transfer the process and results of the study systematically and clearly in both national and international environment by express in writing or orally. |  |  |  |
| **LO 9** | Ability to work effectively in interdisciplinary and multidisciplinary teams, to make leadership in this kind of team and to develop solutions to complex situations, ability to work independently and take responsibility. |  |  |  |

**Prepared by:** Prof. Dr. Selma YARLIGAN UYSAL **Date:** 02.04.15

**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**: