COURSE IDENTIFICATION FORM

Course Code and Name: DIJ111- Digital Literacy				**Department of :** Institute of Graduate Education – Chemical Technologies Department – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	2	0	2	2	3	Turkish	Optional

Prerequisite (s)	None	
Instructor	Prof. Dr. Ragıp ADIGÜZEL	**Mail :**radiguzel@munzur.edu.tr **Web :**www.munzur.edu.tr
Course Assistant	None	**Mail :** **Web :**
Groups / Classes	PhD	
Course Aim	• It is aimed to provide an individual with the ability to use information technologies in line with his/her needs.	
Course Goals	• To increase the knowledge and application capabilities of students in the subjects of Internet Technologies, Portable Technologies, Social Networks, Information Ethics, Technology and Lifelong Learning, Cloud Computing, Technology, Society and Human and Future Technologies.	
Course Learning Outs and Proficiencies	• To be able to define the basic concepts of the Internet • To be able to explain the functions of search engines • To be able to list the types of portable technology • To be able to explain the general features of Web 2.0 and social networks • To be able to summarize the use of technology and people's lifestyles in hunter-gatherer, agricultural, industrial and information societies • To be able to explain the concept and importance of information ethics • To be able to explain human-computer interaction • To be able to explain the basic principles and strategies of lifelong learning	
Course Basic and Auxiliary Contexts	• Electronic resources in PDF, ePUB, MOBI and HTML5 formats prepared by Anadolu University Open Education System • All kinds of books, videos, e-books, etc. related to the course	
Methods of Give a Lecture		

	E-Learning, Digital Platform

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Internet Technologies
2	• Internet Technologies
3	• Portable Technologies
4	• Portable Technologies
5	• Social Networks
6	• Social Networks
7	• Technology, Society and Human
8	• **Midterm Exam**
9	• Technology, Society and Human
10	• Information Ethics
11	• Technology and Lifelong Learning
12	• Technology and Lifelong Learning
13	• Cloud Computing
14	• Future Technologies

COURSE IDENTIFICATION FORM

Course Code and Name: GON111- Volunteering Activities				**Department of :** Institute of Graduate Education – Chemical Technologies Department – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	1	2	3	2	4	Turkish	Optional
Prerequisite (s)	None						
Instructor	All Faculty Members					**Mail :** **Web :**www.munzur.edu.tr	
Course Assistant	None					**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	• The aim is to strengthen the ties between the university and the society by using the knowledge, skills and accumulation that the students have acquired throughout their education; to ensure that they gain sensitivity to various issues and problems in the society, especially migration and disasters, disabled people and disadvantaged groups, with humanitarian, social and economic problems; to ensure that humanitarian, social, cultural and moral values and skills are developed through some volunteer activities that they will participate and carry out, and to increase the visibility and awareness in the society on issues that are of high social sensitivity, such as disabled life, migration and disaster; thus, to ensure that the students take part in voluntary work for a period of time within the scope of a plan to be prepared in advance in a volunteering field of their choice and to share their results.						
Course Goals	• To increase the knowledge and application capabilities of students in the subjects of Internet Technologies, Portable Technologies, Social Networks, Information Ethics, Technology and Lifelong Learning, Cloud Computing, Technology, Society and Human and Future Technologies.						
Course Learning Outs and Proficiencies	• Ability to develop and use the connections between the university and society by using the knowledge, skills and accumulation they have acquired throughout their education. • Ability to cope with human, social, economic etc. problems. • Ability to increase visibility and awareness in society on issues of high social sensitivity such as disabled life, migration and disaster, and the ability to develop new approaches in complex situations and solve them by taking responsibility.						

Course Basic and Auxiliary Contexts	• Field-specific scientific publications
Methods of Give a Lecture	Lecture, Question-Answer, Discussion, Drill and Practice, Demonstration, Group work, Brainstorming, Experiment/Laboratory/Workshop/Field application, Project-based learning (including field work)

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)	X	**100**
	Final Examination		

Semester Course Plan

Week	**Subjects**
1	Concepts of Management and Organization
2	The Concept of Volunteering and Volunteer Management;
3	Basic Volunteering Areas (Disaster and Emergency, Environment, Education and Culture, Sports, Health and Social Services, etc.);
4	Project Development Related to Volunteer Work and Participation in Volunteer Work in the Field;
5	Ethics, Moral, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);
6	Ethics, Moral, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);
7	Ethics, Moral, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);

8	Ethics, Moral, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);
9	Ethics, Moral, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);
10	Ethics, Moral, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);
11	Ethics, Moral, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);
12	Ethics, Morality, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);
13	Ethics, Morality, Religious, Traditional Values and Principles in Volunteer Work; Participation in Volunteer Work in Public Institutions, Local Governments and Non-Governmental Organizations (NGOs);
14	Risk Groups and Volunteerism in Society; Immigrants and Volunteerism.

COURSE IDENTIFICATION FORM							
Course Code and Name: KT6001 Specialization Field Course				**Department of: Chemical Technologies PhD Program**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	6	0	6	0	10	Turkish	Compulsory
Prerequisite (s)							
Instructor	All thesis advisors					**Mail:** **Web:** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	While carrying out teaching activities for students, transferring regional knowledge, experience and knowledge, distributing distribution ethics and work discipline, and providing the ability to follow and evaluate current literature.						
Course Goals	• To provide students with the ability to express their research through oral presentation.						
Course Learning Outs and Proficiencies	• Ability to evaluate, develop and use the information acquired on the thesis subject at an expert level. • Ability to need information and access the information sought. • Ability to observe scientific and ethical values in the stages of collecting, evaluating and publishing data related to the thesis subject. • Ability to devise and develop a method to solve a problem on the thesis subject and to evaluate the results. • Ability to convey current developments and own studies on the thesis subject in written, oral and visual form. • Ability to develop new approaches in complex situations encountered in the thesis subject applications and to solve them by taking responsibility.						
Course Basic and Auxiliary Contexts	• Field-specific scientific publications • Sources determined by the student's thesis advisor						
Methods of Give a Lecture	Lecture, Question and Answer, Discussion						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz		

	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination	X	100
	Practice Examination (Laboratory, Project etc.)		
	Final Examination		

Semester Course Plan

Week	Subjects
1	Determining a research question that is academically consistent and worth examining
2	Presenting a critical approach to the research topic
3	Determining the literature in the relevant field
4	Preparing a thesis proposal
5	Creating a thesis content outline
6	Preparing a timeline
7	Developing data collection tools appropriate for the problem
8	Collection and analysis of data
9	Interpretation of findings
10	Drawing conclusions from research findings
11	Making recommendations based on research results
12	Reporting research results
13	Checking the conformity of research to scientific principles
14	Conducting the writing of the research as a thesis/project

COURSE IDENTIFICATION FORM							
Course Code and Name: KT6002 Doctoral Seminar				**Department of: Chemical Technologies PhD Program**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	0	2	2	0	5	Turkish	Compulsory
Prerequisite (s)							
Instructor	All thesis advisors					**Mail:** **Web:** www.munzur.edu.tr	
Course Assistant						**Mail:** **Web:**	
Groups / Classes	PhD						
Course Aim	To provide students with the ability to conduct comprehensive research on a specific topic and present their findings.						
Course Goals	• To provide students with the ability to express their research through oral presentation.						
Course Learning Outs and Proficiencies	• Determines the topic that will form the basis of the doctoral study to be conducted. • Applies the feedback received in the seminar to the study. • Gains the ability to prepare a presentation. • Gains the ability to make a presentation. • Accesses information in depth and breadth by conducting scientific research, evaluates, interprets and applies information. • Completes and applies information with scientific methods using limited or incomplete data. • Evaluates information from different disciplines. • Determines field-specific problems and explains methods to solve them. • Applies innovative methods in solutions. • Lists new and/or original ideas. • Distinguishes information about current techniques and methods applied in the field of chemical technologies. • Designs and applies analytical, modeling and experimental based research						
Course Basic and Auxiliary Contexts	• Field-specific scientific publications						
Methods of Give a Lecture	Lecture, Question-Answer, Discussion, Drill and Practice, Presentation						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination	X	100
	Practice Examination (Laboratory, Project etc.)		
	Final Examination		

Semester Course Plan

Week	Subjects
1	Determination of the topic for the PhD seminar study
2	Selection of the topic to be studied
3	Literature review
4	Listing of literature studies on the topic
5	Determination of the method on the topic
6	Implementation of the preliminary preparations according to the method determined
7	Putting the study into practice
8	PhD seminar study
9	PhD seminar study
10	PhD seminar study
11	PhD seminar study
12	PhD seminar study
13	Interpretation and presentation of the results of the PhD seminar study
14	Determination of the topic for the PhD seminar study

COURSE IDENTIFICATION FORM							
Course Code and Name: KT6003-PhD Thesis				**Department of: Chemical Technologies PhD Program**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spiring	0	1	1	0	20	Turkish	Compulsory
Prerequisite (s)							
Instructor	All thesis advisors					**Mail:** **Web:** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	Identify a problem/question worth studying/solving in various fields among research/review topics in the field of chemical technologies, conduct a scientifically based research, and write a thesis showing that the research has achieved its goals/objectives and that an original contribution has been made to science/industry.						
Course Goals	• To conduct every stage of a PhD study and to be closely involved in all its details, to write a thesis that includes a clear definition of the problem, a detailed and complete literature review on the subject, the research methods used, a summary of the main findings and the contribution to science/industry, and/or suggestions for further studies.						
Course Learning Outs and Proficiencies	• He/she observes scientific and ethical values in the stages of collecting, evaluating and publishing data related to the thesis topic. • He/she can develop new approaches and take responsibility to solve complex situations that he/she will encounter in the applications on the thesis topic. • He/she can design and develop a method to solve a problem on the thesis topic and evaluate the results. • He/she can evaluate, develop and use the information he/she has acquired on the thesis topic at an expert level. • He/she needs information and can reach the information he/she is looking for. • He/she can convey current developments and his/her own studies on the thesis topic in written, verbal and visual form.						
Course Basic and Auxiliary Contexts	• Articles specific to the field and thesis topic						
Methods of Give a Lecture	Research, literature review, Lecture, Question-Answer, Discussion, Drill and Practice, Demonstration, Group work, Brainstorming, Experiment/Laboratory/Workshop/Field application, Project-based learning (including fieldwork)						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination	**X**	**100**
	Practice Examination (Laboratory, Project etc.)		
	Final Examination		

Semester Course Plan

Week	**Subjects**
1	PhD thesis study
2	PhD thesis study
3	PhD thesis study
4	PhD thesis study
5	PhD thesis study
6	PhD thesis study
7	PhD thesis study
8	PhD thesis study
9	PhD thesis study
10	PhD thesis study
11	PhD thesis study
12	PhD thesis study
13	PhD thesis study
14	PhD thesis study

COURSE IDENTIFICATION FORM

Course Code and Name: KT6004-Project Management				**Department of :** Institute of Graduate Education-Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		All Faculty Members				**Mail :** **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim	• To provide students with information about project management, to develop the ability to evaluate project needs and project planning activities, to define and plan project selection, organization, scope, time and costs, and to develop the ability to program and manage projects with the support of computer software.						
Course Goals	The objective of this course is to teach students the principles of project management and the techniques used in project management.						
Course Learning Outs and Proficiencies	• Can define activities as projects. • Can evaluate project needs and project activities. • Can select projects, organize them, define and plan scope, time and costs. • Can program and manage projects with the support of computer software. • Has theoretical and practical knowledge on project preparation and evaluation of the stages of the project management process.						
Course Basic and Auxiliary Contexts	• Proje Yönetimi Bilgi Birikimi Kılavuzu (PMBOK kılavuzu), Project Management Institute, 2008 • Proje Yönetimi, İsmet Barutçugil, Kariyer Yayıncılık, 2008 • Proje yönetimi, Richard Luecke, Harvard Business School Pres, Türkiye İş Bankası Kültür Yayınları, 2009 • Project Management, A Managerial Approach,Meredith And Mantel 5th edition Wiley int .edition, 2002						
Methods of Give a Lecture	Face-to-Face and Digital Platform. Sample applications, teamwork, presentations, holistic approach to project management						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)	**X**	**100**
	Final Examination		

Semester Course Plan

Week	Subjects
1	Project Management: Introduction
2	Project management cycle, logical framework
3	Project life cycle and organization
4	Project management processes
5	Project integration management
6	Project plan development
7	Resource scheduling
8	**Midterm Exam**
9	Project time and cost management
10	Project procurement management
11	Project human resource management
12	Project communication management, project risk management
13	Computer Software Supported Implementation
14	Computer Software Supported Implementation

COURSE IDENTIFICATION FORM

Course Code and Name: KT6005- Intellectual and Industrial Property Rights				**Department of :** Institute of Graduate Education- Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		All Faculty Members				**Mail :** **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim	• The aim of this course is to provide students with information on intellectual property rights, legal regulations and application processes in the protection of intellectual and industrial property rights.						
Course Goals	The aim of this course is to provide students with information on basic rights and application processes in the fields of patent						
Course Learning Outs and Proficiencies	• Can distinguish the types and conceptual elements of intellectual property rights and evaluate their differences from each other. • Be informed about the current registration procedure in Turkey for intellectual property rights, especially patents, trademarks, designs and geographical indications. • Be informed about the law on intellectual and artistic works. • Understand and interpret the place of computer programs in intellectual property law and the means by which they are protected. • Be able to evaluate the importance of technology transfer agreements in which intellectual property rights and know-how are the subjects, and the reasons and consequences of the exemption granted to these agreements in terms of competition.						
Course Basic and Auxiliary Contexts	• Industrial Property Law • Turkish Patent and Trademark Office, Intellectual Property Rights Training Documents						
Methods of Give a Lecture	Face-to-Face and Digital Platform Observation, Field trip, Case study, Problem/Problem Solving, Brainstorming						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Intellectual property law in general
2	Basic concepts
3	Main elements of the intellectual property system
4	Intellectual and artistic works
5	Moral rights
6	Trademarks
7	Patent concept and application processes
8	Design and application processes
9	Geographical indication application processes
10	New plant varieties-Integrated circuit topographies
11	Know-how (technical and commercial knowledge) concept, protection of know-how
12	Patent databases
13	Freedom of activity research and patent mapping concept
14	Technology transfer concept

COURSE IDENTIFICATION FORM							
Course Code and Name: KT6006- Entrepreneurship				**Department of :** Institute of Graduate Education- Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	-						
Instructor	Prof. Dr. Ragıp ADIGÜZEL					**Mail :**radiguzel@munzur.edu.tr Web :www.munzur.edu.tr	
Course Assistant	-					**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	• To train entrepreneurial individuals by developing their conceptual and application skills on entrepreneurship and innovation. •						
Course Goals							
Course Learning Outs and Proficiencies	• Knows the meaning and importance of entrepreneurship. • Develops entrepreneurship and innovation comprehension skills. • Gains skills to evaluate their talents in terms of entrepreneurship by having innovative approaches. • Gains the ability to develop creative and innovative approaches to business problems.						
Course Basic and Auxiliary Contexts	• Girişimcilik, Orhan Küçük, Seçkin Yayınları, 2013. • Innovation & Entrepreneurship fourth edition, John Bessant and Joe Tidd, Wiley, 2023						
Methods of Give a Lecture	Face-to-Face and Digital Platform Interactive classroom environment, Case and workshop studies.						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)	**X**	**100**
	Final Examination		

Semester Course Plan

Week	Subjects
1	Entrepreneurship in practice and general characteristics of entrepreneurs
2	Creativity and innovation concepts and applications
3	Innovation models
4	Innovative business ideas and applications
5	Business plan scope and content for new ventures
6	Marketing planning in entrepreneurship
7	Production and financial planning in entrepreneurship
8	Strategic planning applications for new ventures
9	Marketing plan applications for new ventures
10	Production planning applications for new ventures
11	Financial planning for new ventures
12	Intellectual asset management
13	Writing and presentation of business plans
14	Writing and presentation of business plans

COURSE IDENTIFICATION FORM

Course Code and Name: KT6007-Scientific Research and Publication Ethic				Department of : Institute of Graduate Education – Department of Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	None						
Instructor	Assoc. Prof. Dr. Güzin PIHTILI					**Mail :** gpihtili@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant	None					**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	The aim of the course is to introduce ethical and scientific research methods, to evaluate scientific ethical values with all their components, especially individual, social and legal aspects, and to discuss them of chemical ethics and chemical technologies.						
Course Goals	•						
Course Learning Outs and Proficiencies	• To be able to understand ethical rules in scientific research • To be able to identify behaviors that are contrary to scientific ethics • To be able to learn about legislation related to scientific ethics • To be able to understand chemical and chemical ethical rules in chemical technologies						
Course Basic and Auxiliary Contexts	Baskent University: Regulations concerning ethical committee on animal experiments, 2003, Baskent University Press. • Biyoloji Budur-Canlı Dünyanın Bilimi. Ernst Mayr, TÜBİTAK, ISBN 978-975-403-481-3, 2008. • Engineering Ethics: An Industrial perspective (Hardcover) by Gail Dawn Baura, 2006, Elsevier Inc. • NanoEthics, Springer Netherlands, ISSN 1871-4757 (Print) 1871-4765 (Online). • Practical Ethics, Singer, P., Cambridge University Pres, (1993).						

Methods of Give a Lecture	Face to Face and Digital Program

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction to ethics and scientific research methods in science and technology,
2	Ethics and rules in scientific research,
3	Behaviors contrary to scientific ethics,
4	Behaviors contrary to scientific ethics,
5	Ethics education in educating scientists,
6	Ethical responsibilities of scientists,
7	Science, society and ethical relations,
8	**Midterm Exam**
9	Ethical principles in scientific publications, Ethics in scientific knowledge production, Plagiarism and ethics, Survey ethics in laboratory and field research, Legal regulations related to ethics by CoHE, TUBITAK, UNIVERSITIES.
10	Ethics in scientific knowledge production, plagiarism and ethics, Survey ethics in laboratory and field research, Legal regulations related to ethics by YOK, TUBITAK, UNIVERSITIES.
11	Plagiarism and ethics,
12	Survey ethics in laboratory and field research,
13	Legal regulations related to ethics by YOK, TUBITAK, UNIVERSITIES.
14	Legal regulations related to ethics by YOK, TUBITAK, UNIVERSITIES.

COURSE IDENTIFICATION FORM

Course Code and Name: KT6008- Inorganic Electronic Spectroscopy				**Department of :** Institute of Graduate Education- Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Ragıp ADIGÜZEL				**Mail :**radiguzel@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		• To determine which types of transitions correspond to the experimentally determined electronic absorption spectra in coordination compounds.					
Course Goals							
Course Learning Outs and Proficiencies		• Upon completion of this course, students will be able to; distinguish between permitted and prohibited transitions according to selection rules, • derive the ground state and excited state term symbols of d-orbitals and rank them in terms of energy, • theoretically calculate the d-d transitions of a complex using Tanebe-Sugana and Orgel diagrams and state which transitions the observed peaks correspond to.					
Course Basic and Auxiliary Contexts		• Gary L. Miessler, Donald A Tarr, İnorganik Kimya, Üçüncü Baskıdan Çeviri Editörleri: Prof. Dr. Nurcan Karacan, Prof. Dr. Perihan Gürkan, Palme Yayıncılık, Ankara, 2009. • A. B. Lever, Inorganic Electronic Spectroscopy,2nd ed., Elsevier, New York, 1986.					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Absorption of light and the Beer-Lambert law
2	Quantum numbers of multi-electron atoms
3	Spin-orbit pairing and term symbols
4	Electronic transitions in molecules and selection rules
5	Electronic transitions in molecules and selection rules
6	Tanabe-Sugana diagrams and d^2-d^8 electron configurations
7	Tanabe-Sugana diagrams and d^2-d^8 electron configurations
8	**Midterm exam**
9	Jahn-Teller decay and spectra (d^1 and d^9 electron configurations)
10	Splitting of terms in the crystal field, Orgel diagrams and 10 Dq
11	Examples of using Tanabe-Sugana diagrams, Determination of Δ_o from spectra
12	Examples of using Tanabe-Sugana diagrams, Determination of Δ_o from spectra
13	Charge transfer bands
14	Interpretation of electronic spectra of complexes

COURSE IDENTIFICATION FORM

Course Code and Name: KT6009-Organometals Chemistry				**Department of :** Institute of Graduate Education-Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Ragıp ADIGÜZEL				**Mail :**radiguzel@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim	• To have an idea about the properties, synthesis and catalysis reactions of organometallic compounds.						
Course Goals							
Course Learning Outs and Proficiencies	• They will learn that organometallic compounds are used as catalysts in the synthesis of many inorganic and organic substances. • They can explain the principle of the metal-carbon bond. • They can distinguish the bonding difference between organometallic compounds and other coordination compounds.						
Course Basic and Auxiliary Contexts	• 1. Gary L. Miessler, Donald A Tarr, İnorganik Kimya, Üçüncü Baskıdan Çeviri Editörleri: Prof. Dr. Nurcan Karacan, Prof. Dr. Perihan Gürkan, Palme Yayıncılık, Ankara, 2009. • 2. Cemal Kaya, İnorganik Kimya, Cilt 2, 3. Baskı, Palme Yayıncılık, Ankara, 2011. • 3. Namık K. Tunalı, Saim Özkar. İnorganik Kimya, Gazi Üniversitesi Yayınları, 1993, Ankara. • 4. G. Spessard, G. Miessler; 1997. Organometallic Chemistry, Prentice Hall, 1997						
Methods of Give a Lecture	Face-to-Face and digital platform						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	General properties, history and recent developments of organometallic compounds
2	Organic ligands and their nomenclature
3	Electron rule (electron counting, 18 electron rule, square planar complexes
4	Ligands (carbonyl complexes, carbonyl-like ligands, hydride and dihydrogen, extended π systems)
5	Organometallic compounds of transition elements, nomenclature of organometallic compounds,
6	Bonds between metal atoms and organic π systems; linear π systems, cyclic π systems, fullerene complexes
7	Bonds between metal atoms and organic π systems; complexes containing M–C, M=C and M≡C bonds (alkyl and similar complexes, carbene complexes, carbyne complexes)
8	**Midterm exam**
9	Synthesis and reactions of organometallic compounds
10	Reactions in which ligands transform into a new structure (intercalation, carbonyl intercalation, 1,2 insertion reactions, hydride separation reactions, extraction reactions
11	Organometallic catalysts (catalytic deuteration, hydroformylation, monsanto acetic acid process, wacker process, hydrogenation with wilkinson catalyst, olefin metathesis)
12	Heterogeneous catalysts (ziegler-Natta polymerizations, water gas reaction
13	Spectrum analysis and structure determination of organometal complexes (FTIR, UV, NMR spectra)
14	Examples on structure determination

COURSE IDENTIFICATION FORM

Course Code and Name: KT6010- Selected Topics In Physical Chemistry				**Department of :** Institute Of Graduate Education – Chemical Technologies - PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Elective
Prerequisite (s)							
Instructor		Doç. Dr. Gülben TORĞUT				**Mail : gtorgut@munzur.edu.tr** **Web :** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim	To ensure a better understanding of some undergraduate physical chemistry topics and the use of information in this field.						
Course Goals							
Course Learning Outs and Proficiencies	• Students become scientific individuals who know and apply the basic laws and principles of physical chemistry, • They can access new scientific information in their field and gain high-level skills in research methods related to their field • They can perform thermodynamic calculations and quantum mechanical calculations • Students gain the ability to be aware of the parameters that may affect their experiments during their experimental work.						
Course Basic and Auxiliary Contexts	• Y. Sarıkaya "Fizikokimya" 3. Baskı, Gazi Kitabevi, Ankara, 2000. • P.W Atkins, "Physical Chemistry" Sixth Edition, Oxford University, 1998.						
Methods of Give a Lecture	Face-to-Face and Digital Platform						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Physicochemical Concepts and First Law of Thermodynamics
2	Second and third laws of thermodynamics
3	Phase diagrams and phase transformations of pure substances
4	Viscosity and surface tension
5	Partial molar properties
6	Rault and Henry laws, introduction to phase diagrams of two-component mixtures
7	A general application and solving questions
8	**Midterm Exam**
9	Application of thermodynamic laws to reactions and chemical equilibrium
10	Thermodynamics of ions and electrolytic conductivity
11	Reaction rates, rate expressions, reaction order
12	Chromatographic methods
13	Reaction mechanisms, catalyst
14	Solving questions

COURSE IDENTIFICATION FORM

Course Code and Name: KTKT6011-Advanced Polymer Chemistry-I				**Department of :** Department of Chemical Technologies PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	-						
Instructor	Assist Prof. Dr. Esra BARIM					**Mail :** esrabarim@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant	-					**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	To give advenced polymer information to MSc and PhD students						
Course Goals	At the end of this course students; • Summarise the polymers and their physical and chemical properties and structure. • Describe molecular weight of polymers, different polymerization methods for preparation of new polymeric materials. • Gives advenced information about polymer chemistry • Gives ability to interpret the reactions during experimental works						
Course Learning Outs and Proficiencies	• Have the ability to apply the theoretical knowledge about polymers in the laboratory, know how to use laboratory techniques in chemical analysis • Make the interpretation of accuracy and precision of experimental data • Can understand the problems of modern chemistry and improve scientific thinking skills • Have the ability to analysis and interpret of experimental data with spectroscopic methods • Follow the developments in science and technology, use the modern techniques and equipments • Performs research and analysis in the field of chemistry technology, gain the ability of access to information and using all kinds of databases • Gain the ability of working as individual and within team • Understand the ethical responsibilities • Can adapt to changing conditions, can work interdisiplinary						
Course Basic and Auxiliary Contexts	• Polymer Chemistry, Raymond B. Seymour, Charles, E. Carraher • Polymer Chemistry, M.Saçak • Polymer Chemistry, Bahattin Baysal • Textbook of Polymer Science, Fred W. Billmeyer Jr. • Polymer Chemistry; Properties and Applications Andrew Peacock and Allison Calhoun						

Methods of Give a Lecture	Lecture, discussion, group work

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Polymer concept, classification and nomenclature of polymers
2	Chemical and physical properties of polymers
3	Thermal transitions in polymers
4	Molecular weight and molecular weight distribution in polymers
5	Determination of molecular weight of polymers
6	Fractionation of polymers and fractionation methods
7	Step-growth polymerization
8	**Midterm exam**
9	Kinetics of step-growth polymerization
10	Free-radical chain polymerization
11	Kinetics of free-radical chain polymerization
12	Determination of rate constants in free-radical chain polymerization
13	Anionic polymerization and polimerization kinetic
14	Cationic polymerization and polimerization kinetic

COURSE IDENTIFICATION FORM

Course Code and Name: KT6012-Advanced Polymer Chemistry-II				**Department of :** Department of Chemical Technologies PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	-						
Instructor	Assist Prof.Dr. Esra BARIM					**Mail :** esrabarim@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant	-					**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	To give advenced polymer information to MSc and PhD students						
Course Goals	At the end of this course students; • Summarise the polymers and their physical and chemical properties and structure. • Different polymerization methods for preparation of new polymeric materials. • Gives advenced information about polymer chains. • Gives ability to interpret the reactions during experimental works • Have knowledge about the application areas of polymers • Gives advenced information about polymer chemistry						
Course Learning Outs and Proficiencies	• Have the ability to apply the theoretical knowledge about polymers in the laboratory, know how to use laboratory techniques in chemical analysis • Make the interpretation of accuracy and precision of experimental data • Can understand the problems of modern chemistry and improve scientific thinking skills • Have the ability to analysis and interpret of experimental data with spectroscopic methods • Follow the developments in science and technology, use the modern techniques and equipments • Performs research and analysis in the field of chemistry technology, gain the ability of access to information and using all kinds of databases • Gain the ability of working as individual and within team • Understand the ethical responsibilities • Can adapt to changing conditions, can work interdisiplinary						

Course Basic and Auxiliary Contexts	• Polymer Chemistry, Raymond B. Seymour, Charles, E. Carraher • Polymer Chemistry, M.Saçak • Polymer Chemistry, Bahattin Baysal • Textbook of Polymer Science, Fred W. Billmeyer Jr. • Polymer Chemistry; Properties and Applications Andrew Peacock and Allison Calhoun
Methods of Give a Lecture	Lecture, discussion, group work

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Coordination polymerization
2	Ring-opening polymerization
3	Atom transfer radical polymerization
4	Copolymerization
5	Types of copolymerization
6	Monomer reactivity ratios
7	Monomer reactivity ratios
8	**Midterm Exam**
9	Block copolymers
10	Graft copolymer
11	Conductive polymers
12	Properties of some conductive polymers
13	Polymerization systems
14	Properties of polymers and applications

COURSE IDENTIFICATION FORM

Course Code and Name: KT6013-Polymeric Composites and Their Characterization				**Department of :** Institute of Graduate Education – Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Gülben TORĞUT				**Mail :** gtorgut@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		Definition of composite and introduction of its components, classification, teaching of its properties and areas of use.					
Course Goals		•					
Course Learning Outs and Proficiencies		• Production of polymeric composite materials, characterization of the produced composite materials and evaluation of their usage areas.					
Course Basic and Auxiliary Contexts		• Funda Tıhmınlıoğlu, Semra Ülkü, Filiz Özmıhçı, Hilal Pehlivan, TÜBİTAK - The Scientific and Technological Research Council of Türkiye, 2002, İZMİR					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	General definition and classification of composite materials
2	Areas of use of composite materials
3	Matrixes
4	Fillers
5	Production methods of polymeric based composite materials
6	General definition and classification of nanocomposite materials
7	Methods used in the characterization of composite and nanocomposite materials
8	XRD and TEM analyses of composite and nanocomposite materials
9	Thermal properties of composite and nanocomposite materials
10	Mechanical properties of composite and nanocomposite materials
11	Physical properties of composite and nanocomposite materials
12	Examples of selected studies in the literature in recent years
13	Properties and areas of use of clay-based polymeric composites
14	Properties and areas of use of PMMA-based composites

COURSE IDENTIFICATION FORM

Course Code and Name:6014-Polymer Technology-I				**Department of :** Institute Of Graduate Education – Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)		
Instructor	Assist. Prof. Dr. Esra BARIM	**Mail :**esrabarim@munzur.edu.tr **Web :**www.munzur.edu.tr
Course Assistant		**Mail :** **Web :**
Groups / Classes	PhD	
Course Aim	To examine the importance, production, usage areas and technologies of polymeric materials widely used in industry and daily life.	
Course Goals	•	
Course Learning Outs and Proficiencies	-Have high knowledge about commercial polymers and technologies that have a wide range of uses. -Use this knowledge in many areas of industry and scientific research. -Have knowledge about the application areas of polymers in technology. -Have the ability to use modern techniques and/or equipment required for their applications.	
Course Basic and Auxiliary Contexts	• M. Saçak " Polimer Teknolojisi" Gazi Kitabevi, Ankara	
Methods of Give a Lecture	Face-to-Face and Digital Platform	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**25**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		**25**
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	General definitions and concepts
2	Inputs used in polymer production
3	Polymerization techniques
4	Thermoplastics and thermoplastic technology
5	Thermoplastics and thermoplastic technology
6	Thermosetting and thermoset technology
7	Thermosetting and thermoset technology
8	**Midterm Exam**
9	Elastomers elastomer technology
10	Elastomers elastomer technology
11	Fibers and fiber technology
12	Fibers and fiber technology
13	Additives used in polymers
14	Polymer processing techniques

COURSE IDENTIFICATION FORM

Course Code and Name: KT6015-Polymer Technology-II				**Department of :** Institute of Graduate Education – Chemical Technologies - PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor	Assist. Prof. Dr. Esra BARIM					**Mail :** esrabarim@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	To examine the importance, production, usage areas and technologies of polymeric materials widely used in industry and daily life.						
Course Goals	•						
Course Learning Outs and Proficiencies	- Have high knowledge about commercial polymers and technologies that have a wide range of uses. - Use this knowledge in many areas of industry and scientific research. - Have knowledge about the application areas of polymers in technology. - Have the ability to use modern techniques and/or equipment required for their applications.						
Course Basic and Auxiliary Contexts	• M. Saçak " Polimer Teknolojisi" Gazi Kitabevi, Ankara						
Methods of Give a Lecture	Face-to-Face and Digital Platform						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**25**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		**25**
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Physical and Chemical Properties of Polymers
2	Effect of Environment on Polymers
3	Solubility in Polymers
4	Combustion of Polymers
5	Electrical Properties
6	Optical Properties
7	Mechanical Properties of Polymers
8	**Midterm Exam**
9	Force Types
10	Deformation
11	Stress and Strain
12	Elastic Deformation, Viscous Deformation
13	Viscoelastic Deformation
14	Stress Strain Relations in Polymers

COURSE IDENTIFICATION FORM

Course Code and Name: KT6016-Thermal Analysis Method				**Department of** : Institute of Graduate Education – Department of Chemical Technologies –PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor	Prof. Dr. Ragıp ADIGÜZEL Assist. Prof. Dr. Esra BARIM					**Mail :**radiguzel@munzur.edu.tr **Web :** www.munzur ed.tr **Mail :**esrabarim@munzur.edu.tr **Web :** www.munzur ed.tr	
Course Assistant	None					**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	• Ability to interpret data obtained as a result of thermal analysis of materials and to solve problems in the field of chemistry.						
Course Goals							
Course Learning Outs and Proficiencies	• Ability to analyze materials used in chemistry applications with thermal analysis methods. • Ability to apply the Differential Thermal Analysis (DTA) technique. • Ability to apply the Thermogravimetric Analysis (TGA) technique. • Ability to apply the Differential Scanning Calorimetry (DSC) technique. • Ability to interpret data obtained from thermal analysis of materials and solve problems in the field of chemistry.						
Course Basic and Auxiliary Contexts	Principles and Applications of Thermal Analysis, Paul Gabbott, Blacweel Publishing, 2007. Thermal Analysis: Fundamentals and Applications to Polymer Science; T. Hatakeyama, F.X.Quinn, Wiley, Thermal Analysis Lecture Notes						
Methods of Give a Lecture	Face to Face and Digital Platform						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**20**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)	X	**30**
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Differential Thermal Analysis (DTA)
2	Differential Thermal Analysis (DTA)
3	Differential Scanning Calorimetry (DSC)
4	Differential Scanning Calorimetry (DSC)
5	Calibration and Sample Preparation
6	Temperature Gradient
7	Thermogravimetric Analysis (TGA)
8	**Midterm Exam**
9	Thermogravimetric Analysis (TGA)
10	Temperature Calibration, Thermal Analysis Applications,
11	Reaction Rate and Kinetics
12	Glass Transition Temperature of Polymers,
13	Purity Analysis and Crystallinity Determination with DSC,
14	Other Thermal Analysis Methods

COURSE IDENTIFICATION FORM

Course Code and Name: KT6017-New and Renewable Energy Sources				**Department of :** Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	-						
Instructor	Assoc. Prof. Dr. Hakan YOĞURTÇU					**Mail :** hakanyogurtcu@gmail.com **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	• Learning the advantages and disadvantages of clean and renewable alternative energy sources. Discussing the renewable energy potentials in the world and in Turkey and the usability of this potential. Researching solution proposals for the energy problem.						
Course Goals							
Course Learning Outs and Proficiencies	• Understand the importance of renewable energy sources compared to traditional fossil fuels • Learn energy production and energy conversion methods that can be applied to renewable energy sources • Compare and evaluate various energy sources in terms of efficiency, continuity, economy and applicability • Have knowledge about the future of renewable energy sources and technologies • Learn energy policies related to renewable energy sources						
Course Basic and Auxiliary Contexts	• John W. Twidell and Anthony D. Weir, Renewable Energy Resources, Chapman and Hall, 2006 • Johansson T. B., Kelly H., Reddy A.K.N., Williams R.H., Renewable Energy, 1993. • Öztürk, H., Yenilenebilir Enerji Kaynakları, Birsen Yayınevi, 2013						
Methods of Give a Lecture							

	Face-to-Face and digital platform supported

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Energy, energy sources and the concept of clean energy
2	Non-renewable and renewable energy sources
3	Fossil-based energy sources and the environment
4	Solar Energy
5	Wind Energy
6	Hydraulic energy and marine-based energy
7	Hydrogen Energy and Fuel Cells
8	**Midterm Exam**
9	Biomass energy: Sources and importance
10	Biomass energy: Biodiesel, Bioethanol, Biogas
11	Current status of renewable energy sources and technologies
12	Future of renewable energy sources and technologies
13	Comparison of non-renewable and renewable energy sources
14	Importance of renewable energy sources in energy policies

COURSE IDENTIFICATION FORM

Course Code and Name: KT6018-Numerical Analysis and Computer Application				**Department of :** Department of Chemical Technologies-PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Hakan YOĞURTÇU				**Mail :** hakanyogurtcu@gmail.com **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		• Analysis of equations used in the chemical industry, especially in engineering applications, and the realization of numerical solutions with the help of computer programs.					
Course Goals							
Course Learning Outs and Proficiencies		• To use knowledge of equation analysis and matrix principles in problem solving • • To be able to solve numerical algebraic, non-algebraic and differential equations • • To be able to solve numerical equations of fluid flow, heat transfer and mass transfer problems • • To gain the ability to use computers in problem solving					
Course Basic and Auxiliary Contexts		• R. G. Rice and D. D. Do, Applied Mathematics and Modeling for Chemical Engineers by, John Wiley & Sons Inc., New York, 1994. • Canale, R., Chapra, S., Mühendisler İçin Sayısal Yöntemler, Çeviri: Hasan Heperkan, Literatür Yayınevi, 2011.					
Methods of Give a Lecture		Face-to-Face and digital platform supported					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz		
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)	**X**	**50**
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Summary of computer programming languages
2	Matrices
3	Matrix solutions
4	Numerical solutions of algebraic equation systems
5	Numerical solutions of algebraic equation systems
6	Numerical solutions of non-algebraic equation systems
7	Numerical solutions of non-algebraic equation systems
8	Numerical solutions of higher order differential equations
9	Numerical solutions of higher order differential equations
10	Numerical solutions of partial differential equations
11	Modeling and numerical solutions of fluid flow problems
12	Modeling and numerical solutions of heat transfer problems
13	Modeling and numerical solutions of mass transfer problems
14	Numerical solutions of reaction engineering problems

COURSE IDENTIFICATION FORM

Course Code and Name: KT6019-Drying Technology				**Department of :** Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)		-					
Instructor		Assoc. Prof. Dr. Hakan YOĞURTÇU				**Mail :** hakanyogurtcu@gmail.com **Web :** www.munzur.edu.tr	
Course Assistant		-				**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		• To introduce drying technology, which is one of the application branches of chemical technologies • To provide information about the methods applied in drying technology • To provide the knowledge and skills to analyze the quality and factors affecting quality in dried products • To provide information about new techniques applied in drying technology					
Course Goals							
Course Learning Outs and Proficiencies		• Learning the concepts of drying and drying technology • Learning the elements that affect product quality in the Chemistry and Food industry • Understanding the importance of Chemistry and Food drying techniques. • Learning the modeling of the drying process.					
Course Basic and Auxiliary Contexts		• Mujumdar A.S., Handbook of Industrial Drying, Taylor & Francis Group LLC, 2006. • Nema, P. K. , Kaur, B.P, Mujumdar, A.S., Drying Technologies for Foods: Fundamentals and Applications, New India Publishing Agency, 2015 B. Cemeroğlu, Meyve ve Sebze Teknolojisi II, Gıda Teknolojisi Derneği Yayınları, Ankara, 2004.					
Methods of Give a Lecture		Face-to-Face and digital platform supported					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Importance of drying
2	Water activity
3	Water sorption isotherms
4	Physical properties of air-water mixtures
5	Basic principles of drying
6	Drying speed and its calculation
7	Factors affecting drying speed
8	**Midterm exam**
9	Fruit and vegetable drying
10	Changes in the structure of dried products and quality elements
11	Drying methods
12	Drying methods
13	Approximate solution of heat transfer problems by finite difference method
14	Approximate solution of heat transfer problems by finite difference method

COURSE IDENTIFICATION FORM

Course Code and Name: KT6020-Advanced Electrochemistry	Department of : Institute of Graduate Education – Department of Chemical Technologies – PhD Program

Semester	Theoretic Hour	Practice Hour	Total Hour	Credits	ECTS	Education Language	Type: Compulsory Elective
Fall/Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)	None	
Instructor	Assoc. Prof. Dr. Yeliz İPEK	**Mail :** yelizipek@munzur.edu.tr **Web :** https://akademik.yok.gov.tr/AkademikArama/view/viewAuthor.jsp
Course Assistant	None	**Mail : Web :**
Groups / Classes	PhD	
Course Aim	To gain knowledge about electrochemical processes and their calculations.	
Course Goals	To provide information about analytical electrochemistry, electrode types, chemically modified electrodes, solvent and support electrolytes, electrochemical coatings and batteries.	
Course Learning Outs and Proficiencies	Upon completion of the course, students will; • Know the elements and their properties used in electrochemical processes, • Know the basic principles of analytical electrochemistry, • Have knowledge about coatings and batteries.	
Course Basic and Auxiliary Contexts	• Peter T. Kissinger, William R. Heineman, Laboratory Techniques in Electroanalytical Chemistry, Second Edition, Marcel Dekker Inc., New York, Basel, Hong Kong, 1996.	
Methods of Give a Lecture	Face to Face and Digital Platform	

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Fundamentals of analytical electrochemistry
2	Fundamentals of analytical electrochemistry
3	Carbon electrodes
4	Film electrodes
5	Mercury electrodes
6	Chemically modified electrodes
7	Solvent and support electrolytes
8	Midterm exam
9	Electroorganic synthesis
10	Electroorganic synthesis
11	Coatings
12	Coatings
13	Batteries
14	Batteries

COURSE IDENTIFICATION FORM

Course Code and Name: KT6021-Electrochemical Sensors				Department of : Institute of Graduate Education – Chemical Technologies Department – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	None						
Instructor	Assoc. Prof. Dr. Yeliz İpek					**Mail : yelizipek@munzur.edu.tr Web : https://akademik.yok.gov.tr/AkademikArama/view/viewAuthor.jsp**	
Course Assistant	None					**Mail : Web :**	
Groups / Classes	PhD						
Course Aim	To teach how to design electrochemical sensors and evaluate sensor measurement results.						
Course Goals	• To teach electrochemical analysis methods, designing electrodes for a specific analyte and mathematical modelling of the designed sensor.						
Course Learning Outs and Proficiencies	Upon completion of the course, students will; • Know the measurement techniques used in electrochemical processes, • Know the methods of designing electrodes to be used as sensors, • Evaluate the electrochemical sensor measurement results.						
Course Basic and Auxiliary Contexts	• Peter T. Kissinger, William R. Heineman, Laboratory Techniques in Electroanalytical Chemistry, Second Edition, Marcel Dekker Inc., New York, Basel, Hong Kong, 1996.						

Methods of Give a Lecture	Face to Face and Digital Platform

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction to electrochemistry
2	Electrochemical measurement techniques
3	Electrochemical measurement techniques
4	Design of electrochemical processes
5	Design of electrochemical processes
6	Introduction to electrochemical sensors and biosensors
7	Electrode preparation techniques
8	Midterm exam
9	Electrode preparation techniques
10	Measurement techniques in electrochemical sensors
11	Measurement techniques in electrochemical sensors
12	Evaluation and calculations of sensor measurements
13	Evaluation and calculations of sensor measurements
14	Evaluation and calculations of sensor measurements

COURSE IDENTIFICATION FORM

Course Code and Name: KT6022-Thin Film Coating Techniques	Department of : Institute of Graduate Education – Department of Chemical Technologies – PhD Program

Semester	Theoretic Hour	Practice Hour	Total Hour	Credits	ECTS	Education Language	Type: Compulsory Elective
Fall/Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)	None	
Instructor	Assoc. Prof. Dr. Yeliz İpek	**Mail :** yelizipek@munzur.edu.tr **Web :** https://akademik.yok.gov.tr/AkademikArama/view/viewAuthor.jsp
Course Assistant	None	**Mail : Web :**
Groups / Classes	PhD	
Course Aim	To teach thin film coating techniques and to provide the ability to examine and present a scientific study.	
Course Goals	• To teach how to apply the dip coating technique, spin coating technique, Langmuir-Blodgett coating technique, sol-gel coating technique, electrochemical coating technique, chemical vapor deposition technique and physical vapor deposition technique.	
Course Learning Outs and Proficiencies	Upon completion of the course, students will; • Know the importance and areas of use of thin film coating techniques, • Know thin film coating techniques, • Have experience in reviewing articles and presenting a scientific study.	
Course Basic and Auxiliary Contexts	• David A., Shah S.I., Handbook of Thin Film Process Technoloy, Institute of Physics Publishing, Bristol and Philadelphia, 1995. • Yrd. Doç. Dr. Atilla Evcin Afyonkarahisar Kocatepe Üniversitesi Kaplama Teknikleri Ders Notları, 2006. • Savaş SÖNMEZOĞLU, Mehmed KOÇ, Seçkin AKIN, İnce film üretim teknikleri, Erciyes Üniversitesi Fen Bilimleri Enstitüsü Dergisi, 28(5):389-401.	

Methods of Give a Lecture	Face to Face and Digital Platform

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction to thin film coating processes
2	Dip coating technique
3	Spin coating technique
4	Langmuir-Blodgett coating technique
5	Sol-gel coating technique
6	Electrochemical coating technique
7	Chemical vapor deposition technique
8	**Midterm Exam**
9	Physical vapor deposition technique
10	Article review and presentation
11	Article review and presentation
12	Article review and presentation
13	Article review and presentation
14	Introduction to thin film coating processes

COURSE IDENTIFICATION FORM

Course Code and Name: KT6023-Advanced Fluid Mechanics				**Department of :** Department of Chemical Technologies-PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Hakan YOĞURTÇU				**Mail :** hakanyogurtcu@gmail.com **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		To provide more advanced information on topics related to fluid mechanics					
Course Goals		•					
Course Learning Outs and Proficiencies		• Learning advanced approaches to fluid flow and applying them to flow problems.					
Course Basic and Auxiliary Contexts		• Young, Munson, Okiishi & Huebsch, “A Brief Intorduction to Fluid Mechanics” • Çengel & Cimbala, “Fluid Mechanics”					
Methods of Give a Lecture		Face-to-Face and digital platform supported					

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**10**
	2. Quiz	**X**	**10**
	3. Quiz	**X**	**15**
	4. Quiz	**X**	**15**
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction. Basic concepts of fluid mechanics
2	Conservation of mass, energy, momentum
3	Inviscid flow
4	Viscous flow
5	Lagrangian approximation
6	Eulerian approximation
7	Fluid properties, Rheology
8	Fluid kinematics and deformation
9	Boundary layer
10	Turbulence
11	Drift, Dynamics of rotating fluids and torque
12	Drift, Dynamics of rotating fluids and torque
13	Flow separation
14	Basic problems of fluid mechanics

COURSE IDENTIFICATION FORM

Course Code and Name: KT6024-Biopolymers				**Department of :** Institute Of Graduate Education – Chemical Technologies - PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Nedim GÜRLER				**Mail :** nedimgurler@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		To explain the difference between synthetic polymers and biopolymers and to educate students about the use of polymers obtained from biological sources in biomedical and environmental fields.					
Course Goals		• To provide students with competence in bio-derived polymers.					
Course Learning Outs and Proficiencies		• At the end of this course, students will have information about biopolymers, • Students will have information about the application areas of biopolymers in different areas, • Students will learn that biopolymers can be used in an environmentally friendly way instead of synthetic polymers that cause environmental pollution.					
Course Basic and Auxiliary Contexts		• Saçak M., Polymer Technology, Gazi Bookstore, Ankara, 2017. • Lecture notes					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Polymers
2	General information about synthetic polymers and biopolymers
3	Biodegradable polymers
4	Structure-property relationships in biodegradable polymers
5	Areas of use of biodegradable polymers
6	Use of biodegradable polymers as food packaging
7	Starch, cellulose and chitosan
8	**Midterm Exam**
9	Polymer modification, Modified starch and areas of use
10	Mechanical properties of biodegradable polymers
11	Water barrier properties in biodegradable polymers
12	Biodegradation mechanisms of polymers
13	Biodegradation
14	Smart polymers

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COURSE IDENTIFICATION FORM

Course Code and Name: KT6025- Food Packaging				**Department of :** Institute of Graduate Education – Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Nedim GÜRLER				**Mail :** nedimgurler@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		The aim of this course is to teach students food packaging and packaging technologies.					
Course Goals		To provide students with competence in food packaging and preservation.					
Course Learning Outs and Proficiencies		• Understand the importance of biodegradable polymers in food packaging, • Determine the packaging material suitable for food, • Have information about different packaging materials, • Have information about smart packaging.					
Course Basic and Auxiliary Contexts		• Lecture notes • Food packaging technology, Mustafa Üçüncü					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**

	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction to food packaging
2	Paper and cardboard packaging,
3	Glass packaging and its properties Metal packaging and its properties
4	Active and smart packaging
5	Plastic packaging
6	Use of biodegradable polymers as food packaging
7	Use of starch cellulose as packaging material
8	**Midterm Exam**
9	Polymer modification, Modified starch and its areas of use
10	Areas of use of modified starch and cellulose
11	Areas of use of modified starch and cellulose
12	Food packaging interaction
13	Food packaging interaction
14	Mechanical and barrier properties of biodegradable polymers in food packaging

DERS TANITIM FORMU

Dersin Kodu ve Adı: KT6026 Nano-Sentez ve Karakterizasyon				Anabilim Dalı: Kimyasal Teknolojiler Anabilim Dalı Doktora Programı			
Yarıyıl	**Teorik Saati**	**Uygulama Saati**	**Toplam Saati**	**Kredisi**	**AKTS**	**Öğretim Dili**	**Türü: Zorunlu/ Seçmeli**
GÜZ/BAHAR	3	0	3	3	5	Türkçe	Seçmeli

Ön Koşullar	Yok	
Öğretim Elemanı	Prof. Dr. Muharrem İNCE	**Mail:** muharremince@munzur.edu.tr **Web:** www.munzur.edu.tr
Ders Yardımcısı		**Mail:** **Web:**
Gruplar Sınıflar	Doktora	
Dersin Amacı	Nano-yapıların başlıca sentez metotlarını neler olduğu ve nano-yapıların karakterizasyonu için sıklıkla kullanılan metotların neler olduğunu, hangi amaçla kullanıldığının öğrenilmesi.	
Dersin Hedefleri	Nano-yapıların başlıca sentez metotlarını neler olduğu (Plazma ark yöntemi, öğütme, sol-gel vb) ve nasıl kullanıldığının belirlenmesi. Sentezlenen nano-yapıların boyutu, şekli, yüzey alanı özelliklerinin belirlenmesi; nano-yapıların karakterizasyonu için ihtiyaç duyulan spektroskopik ve diğer yöntem ve tekniklerin malzemelerin yapısal, fiziksel, elektriksel ve manyetik özelliklerin başlıca ölçme/görüntüleme yöntemlerin saptanması.	
Dersin Öğrenme Çıktıları ve Yeterlilikleri	• Nano-yapıların başlıca sentez metotlarını neler olduğu ayırt edebilecek, • Sentez aşamasında malzemenin özelliğine göre yöntem seçebilecek, • Nanoyapılı malzemelerin tanımının ne anlama geldiğini ve genel malzemelerden farkını ayırt edebilecek, • Bilimsel araştırma yaparak bilgiye ulaşır, bilgiyi değerlendirir, yorumlar ve yeni durumlara uyarlayabilir. • Nano-yapıların başlıca karakterizasyon teknikleri hakkında kapsamlı bilgi sahibidir. • Mesleğinin yeni ve gelişmekte olan uygulamalarının farkında olup, gerektiğinde bunları inceler ve öğrenir. • Uygulamada problemlerini kurgular, çözmek için yeni ve/veya özgün fikir ve yöntemler geliştirir ve yenilikçi çözümler bulur.	
Dersin Temel ve Yardımcı Kaynakları	• Fundamentals and Applications of Nanomaterials, Z. Guo, L. Tan, Artech House 2009, ISBN-13:978-1-59693-262-3 • Nanomaterials: Synthesis, Characterization, and Applications (Advances in Nanoscience and Nanotechnology), by A. K. Haghi, A. K. Zachariah, N. Kalariakkal, Apple Academic Press (14 Mar 2013), ISBN-10: 1926895193 ISBN-13: 978-1926895192 • Ders notları ve bilimsel makaleler	
Dersin İşleniş Yöntemi	• Yüz yüze anlatım, Powerpoint sunumları, Soru-yanıt, Tartışma	

Değerlendirme Ölçütleri		**Varsa (X) Olarak İşaretleyiniz**	**Genel Ortalamaya Yüzde (%) Katkı**
	1. Ara Sınavı	X	**50**
	2. Ara Sınavı		
	3. Ara Sınavı		
	4. Ara Sınavı		
	Sözlü Sınavı		
	Uygulama Sınavı (Laboratuar, Proje vb.)		
	Yarıyıl Sonu Sınavı	X	**50**

Yarıyıl Ders Planı

Hafta	**Konuları**
1	Nano-sentez nedir? Başlıca nano-sentez metotları
2	Nano-sentez metotları
3	Karakterizasyon Yöntemleri: Zeta potansiyeli
4	Karakterizasyon Yöntemleri: Geçirimli Elektron Mikroskobu (TEM)
5	Karakterizasyon Yöntemleri: Taramalı Elektron Mikroskobu (SEM)
6	Karakterizasyon Yöntemleri: Atomik Kuvvet Mikroskobu (AFM)
7	Karakterizasyon Yöntemleri:Taramalı Tünelleme Mikroskobu (STM)
8	Karakterizasyon Yöntemleri: X-Işını Kırınım Spektroskopisi (XRD)
9	Karakterizasyon Yöntemleri: Fourier Dönüşümlü Kızıl Ötesi (FT-IR) Spektroskopisi
10	Karakterizasyon Yöntemleri: İndüktif Eşleşmiş Plazma-Kütle Spektrometresi (ICP-MS)
11	Karakterizasyon Yöntemleri: Ultraviyole-Görünür Bölge (UV-GB) Spektroskopisi
12	Kullanılan diğer karakterizasyon teknikleri
13	Proje sunumları
14	Proje sunumları

COURSE IDENTIFICATION FORM

Course Code and Name: KT6027-Polymers Degradation				**Department of :** Institute of Graduate Education – Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)		-					
Instructor		Assoc. Prof. Dr. Nedim GÜRLER				**Mail :** nedimgurler@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant		-				**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		The aim of this course is to educate students about thermal, mechanical, enzymatic and biodegradation of polymers.					
Course Goals		To provide students with proficiency in photo, enzymatic, bio and thermal degradation of polymers.					
Course Learning Outs and Proficiencies		• Have knowledge about the degradation mechanism of polymers, • Have knowledge about thermal, enzymatic, mechanical, photodegradation and biodegradation.					
Course Basic and Auxiliary Contexts		• Lecture notes					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction, degradation
2	Thermal degradation
3	Thermal degradation
4	Mechanical degradation
5	Mechanical degradation
6	Photodegradation
7	Photodegradation
8	**Midterm Exam**
9	Enzymatic degradation
10	Mechanical and barrier properties in the biodegradation of polymers
11	Biodegradation
12	Biodegradation in controlled composting environment
13	Biodegradation in controlled composting environment
14	Biopolymer biodegradation mechanism

COURSE IDENTIFICATION FORM							
Course Code and Name: KT6028 Nanoscience and Nanotechnology				**Department of: Chemical Technologies PhD Program**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
FALL/SPRING	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	Not						
Instructor	Prof. Dr. Olcay KAPLAN INCE					**Mail:** olcaykaplan@munzur.edu.tr **Web:** www.munzur.edu.tr	
Course Assistant						**Mail:** **Web:**	
Groups / Classes	PhD						
Course Aim	To introduce the basic principles and theories of nano-science, nano-materials and nano-technologies with the developing and transforming world. To provide the students who take the course with knowledge and skills about nano-science and nanotechnology, to emphasize that this current and constantly developing branch of science is very related to lifelong learning, as well as to explain the properties of nano-scale materials used for this purpose and introduce their applications.						
Course Goals	• To learn definitions and development processes of nano-science, nano-engineering and nano-technology; nanotechnological concepts and properties of nanomaterials together with measurement methods. • Determination of size and shape properties of nanomaterials, surface structures, properties and usage areas of nano-particles; effects of nano-material on ecosystem and organism. • To understand the synthesis and analysis methods of nano-structures.						
Course Learning Outs and Proficiencies	• Will be able to comprehend the importance of nano-science, nano-engineering and nano-technology. • Will be able to learn the properties of nano-scale structures. • Will be able to learn about the application areas of nanotechnology. • Will be able to learn the production and imaging methods of nanostructures.						
Course Basic and Auxiliary Contexts	• Charles P. Poole, and Frank J. Owens, (2003), Introduction to nanotechnology, John Wiley&Sons, Inc. ABD • M. Köhler, Wolfgang Fritzsche, (2004), Nanotechnology, Wiley-VCH Verlag GmbH, Almanya • Jeremy Ramsden, (2011). Fundamentals of Nanotechnology. METU publishing. • Lecture notes and scientific articles						
Methods of Give a Lecture	Face-to-Face and Digital Platform, Powerpoint presentations, Question and answer, Discussion						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Nano-science, nano-engineering and nano-technology in the light of developing and transforming science
2	Current developments in nano-science and nano-technology
3	Nano-engineering and application areas
4	Relationship between nanomaterial properties and measurement methods
5	Characterization of nanoparticles
6	Characterization of nanoparticles
7	Synthesis of nanoparticles: Biosynthesis
8	Synthesis of nanoparticles: Chemical synthesis methods
9	Synthesis of nanoparticles: Chemical synthesis methods
10	Metal-based nanoparticles
11	Carbon-based nanostructures
12	Hybrid nanostructures
13	Hybrid nanostructures
14	The future of nanotechnology

COURSE IDENTIFICATION FORM							
Course Code and Name: KT6029 Nanotechnology and Application Areas				**Department of : Chemical Technologies PhD Program**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
FALL/SPRING	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	Not						
Instructor	Prof. Dr. Olcay KAPLAN INCE					**Mail:** olcaykaplan@munzur.edu.tr **Web:** www.munzur.edu.tr	
Course Assistant						**Mail:** **Web:**	
Groups / Classes	PhD						
Course Aim	To introduce nanotechnology and the basic principles and theories of these technologies in the light of developments in science and technology. To introduce nanoscale materials used in nanotechnology and their applications and superior properties. To gain knowledge and skills related to nanotechnology and its application areas.						
Course Goals	• Definitions and history of nanoscience, nanoengineering, nanotechnology concepts; measurement methods of nanoproperties; • To understand the shape and size of nanoparticles, surface structures, properties of nanoparticles as well as the usage areas of nanotechnology.						
Course Learning Outs and Proficiencies	• Will be able to comprehend the importance of nanoscience and nanotechnology. • Will be able to learn the properties of nano-sized particles. • Will be able to learn about the application areas of nanotechnology. • Will be able to compare the advantages and disadvantages of this technology in practice.						
Course Basic and Auxiliary Contexts	• Charles P. Poole, and Frank J. Owens, (2003), Introduction to nanotechnology, John Wiley&Sons, Inc. ABD • M. Köhler, Wolfgang Fritzsche, (2004), Nanotechnology, Wiley-VCH Verlag GmbH, Almanya • Jeremy Ramsden, (2011). Fundamentals of Nanotechnology. METU publishing. • Lecture notes and scientific articles						
Methods of Give a Lecture	Face-to-Face and Digital Platform, Powerpoint presentations, Question and answer, Discussion						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	The development process of nanotechnology
2	Nanotechnological developments in basic sciences
3	Applications of nanotechnology: Science and education
4	Applications of nanotechnology: Science and education
5	Applications of nanotechnology: Biotechnology and agriculture
6	Applications of nanotechnology: Biotechnology and agriculture
7	Applications of nanotechnology: Nanoelectronics and computers
8	Applications of nanotechnology: Nanoelectronics and computers
9	Applications of nanotechnology: Aviation and space
10	Applications of nanotechnology: Aviation and space
11	Applications of nanotechnology: Pharmacy and nanomedicine
12	Applications of nanotechnology: Pharmacy and nanomedicine
13	New areas of nanotechnology
14	New areas of nanotechnology

COURSE IDENTIFICATION FORM							
Course Code and Name: KT6030 Green Chemistry and Sustainability				**Department of: Chemical Technologies PhD Program**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	Not						
Instructor	Prof. Dr. Muharrem INCE					**Mail:** muharremince@munzur.edu.tr **Web:** www.munzur.edu.tr	
Course Assistant						**Mail:** **Web:**	
Groups / Classes	PhD						
Course Aim	In the context of green chemicals and sustainability, it is to serve academic needs and industrial applications in production, research and development in the fields of environment, medicine, food, etc.						
Course Goals	• Why green chemistry, basic principles, environment, health and safety integration, method selection, material selection and identification of bioprocesses.						
Course Learning Outs and Proficiencies	• Learn about green chemistry in the context of sustainability. • Learn about the application areas of green chemistry. • Learn the relationship between green chemistry and engineering.						
Course Basic and Auxiliary Contexts	• Green Chemistry and The Ten Commandments of Sustainability 2nd ed Stanley E. Manahan 2006 ChemChar Research, Inc Publishers Columbia, Missouri U.S.A. • Green Chemistry and Catalysis. I. Arends, R. Sheldon, U. Hanefeld Copyright © 2007 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim ISBN: 978-3-527-30715-9. • Green Chemistry and Engineering: A Pathway to Sustainability, Anne E. Marteel-Parrish, Martin A. Abraham, Print ISBN:9780470413265 |Online ISBN:9781118720011 |DOI:10.1002/9781118720011 Copyright © 2014 American Institute of Chemical Engineers, Inc. • Lecture notes and scientific articles						
Methods of Give a Lecture	Face to face lectures, Powerpoint presentations, Question &Answer, Discussion						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Green chemistry and sustainability
2	Green chemistry and green engineering
3	Green chemistry principles
4	Green chemistry principles
5	Green chemistry; integration of environment, health and safety
6	Green chemistry; integration of environment, health and safety
7	How do we know it is green?
8	Choosing paths and chemistry in green chemistry and green engineering
9	Material selection; solvents, catalysts and reagents
10	Reaction conditions and green chemistry
11	Bioprocesses
12	Bioprocesses
13	From lab to plant
14	From lab to plant

COURSE IDENTIFICATION FORM

Course Code and Name: KT6031-Separation Methods in Analytical Chemistry				**Department of :** Institute of Graduate Education – Department of Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	None						
Instructor	Prof. Dr. Olcay KAPLAN İNCE					**Mail:** olcaykaplan@munzur.edu.tr **Web:** www.munzur.edu.tr	
Course Assistant	None					**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	Explain the importance of separation methods in chemical analysis.						
Course Goals	To provide information about analytical electrochemistry, electrode types, chemically modified electrodes, solvent and support electrolytes, electrochemical coatings and batteries.						
Course Learning Outs and Proficiencies	1. Understand and distinguish concepts such as separation methods, recovery, enrichment factor, 2. Classify chemical separation methods, 3. Explain, classify extraction and explain the differences between extraction types, 4. Explain the basic principles of chromatographic separation, classify chromatographic methods, 5. Explain concepts such as peak shapes, column efficiency, Van Deemter equation, relative retention rate, qualitative and quantitative analysis related to chromatography						
Course Basic and Auxiliary Contexts	• Rouessac, F., Rouessac, A., (2000), Chemical analysis: Modern Instrumentation, methods and techniques , John Wiley and Sons.						
Methods of Give a Lecture							

	Face to Face and Digital Platform, Powerpoint presentations, Q&A, Discussion

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**20**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)	**X**	**30**
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction to separation methods: Nature of separation process, recovery and enrichment factor, classification of chemical separation methods
2	Separation based on selective precipitation and selective evaporation
3	Extraction: Technique of liquid-liquid extraction
4	Solid phase extraction, Supercritical fluid extraction
5	Chromatography: Basic principles of chromatographic separation, classification of chromatographic methods
6	Chromatographic Concepts: Peak shapes, column efficiency, Van Deemter equation, relative retention rate, qualitative and quantitative analysis
7	Gas chromatography: Basic principles of GC analysis, GC instrument
8	Gas chromatography: Stationary phases and types of detectors
9	Liquid chromatography: Basic principles of HPLC analysis, types of HPLC instrument, column and detector
10	Types of retention mechanisms of liquid chromatography: adsorption, (normal phase and reverse phase), partitioning, ion exchange
11	Paper chromatography (PC) and thin layer Basic principles of chromatography (TLC)
12	Basic principles of electrophoresis and electrophoretic separation
13	Homework Presentation
14	Homework Presentation

COURSE IDENTIFICATION FORM

Course Code and Name: KT6032-Sample Preparation Techniques in Analytical Chemistry				**Department of :** Institute of Graduate Education – Department of Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	None						
Instructor	Prof. Dr. Muharrem İNCE					**Mail :**muharreminc e@munzur.edu.tr **Web:** www. munzur.edu.tr	
Course Assistant	None					**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	In this course, the importance of sample preparation techniques will be explained. It is aimed to detail the extraction techniques for inorganic and organic analytes.						
Course Goals							
Course Learning Outs and Proficiencies	1. Be able to learn sample preparation methods for metals and organic compounds in solid and liquid samples 2. Be able to classify extraction and enrichment methods, develop analytical skills, discuss results 3. Be able to explain measurement processes, errors in quantitative analysis, method validation, quality control in sample preparation 4. Be able to analyze selected components in the matrix, and interpret analysis results						
Course Basic and Auxiliary Contexts	• Sample Preparation Techniques in Analytical Chemistry, Edited By: Somenath Mitra, John Wiley and Sons, 2003 • Sampling Problems for the chemical analysis of sludge, soils, & plants, Elsevier, 1986						
Methods of Give a Lecture	Face to Face and Digital Platform, Powerpoint Presentations, Q&A, Discussion						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**20**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)	**X**	**30**
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Measurement process, qualitative and quantitative analysis, errors in quantitative analysis
2	Method precision, method validation, sample storage
3	Extraction and enrichment in sample preparation, extraction principles, liquid-liquid extraction
4	Liquid solid extraction, solid phase extraction
5	Sorbent selection and recovery, recent developments in solid phase extraction
6	Solid phase microextraction, sorbents, sorbent selection, recent developments in technique
7	Sorbent selection, recent developments in technique
8	Method comparison
9	Extraction of organic compounds from solid matrices
10	Extraction of volatile organic compounds from solids and liquids
11	Preparation of samples for metal analysis
12	Homework presentation
13	Homework presentation
14	Homework presentation

COURSE IDENTIFICATION FORM

Course Code and Name: KT6033- Biofuels				**Department of :** Institute of Graduate Education- Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Ragıp ADIGÜZEL				**Mail :**radiguzel@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		• Learning the terms biomass and biofuel • 2. Learning biomass energy and its types • 3. Understanding the importance of biofuels in our country and in the world sectors • 4. Learning about biofuel technology					
Course Goals							
Course Learning Outs and Proficiencies		• 1. At the end of this course, students will have extensive knowledge about biomass and biofuels. • 2. Learn energy production from biomass. • 3. Learn types of biofuels. • 4. Learn factors affecting biofuel production. • 5. Learn biofuel technology, raw materials used in biofuel production and production processes.					
Course Basic and Auxiliary Contexts		• 1. Anju Dahiya, Bioenergy: Biomass to Biofuels 1st Edition, Elsevier, Academic Press, 2015. • 2. Lecture notes					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	History of Biomass Energy
2	Biomass Energy
3	Types of Biomass Energy
4	Obtaining Energy from Biomass
5	Biofuels
6	Biofuels
7	Importance of Biofuels in the Sector
8	**Midterm Exam**
9	Factors that Trigger Biofuel Production
10	World Biofuel Production
11	Biofuel Technology
12	Raw Materials and Production Process Used in Biofuel Production
13	Raw Materials and Production Process Used in Biofuel Production
14	Literature Research

COURSE IDENTIFICATION FORM

Course Code and Name: KT6034- Coordination Polymers				**Department of :** Institute of Graduate Education- Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Ragıp ADIGÜZEL				**Mail :**radiguzel@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		• 1. To learn the synthesis methods by defining the coordination polymer • 2. To learn the situations that provide the diversity of coordination polymers • 3. To examine the areas of use of coordination polymers • 4. To examine the current studies on coordination polymers in various sizes					
Course Goals							
Course Learning Outs and Proficiencies		• 1. At the end of this course, students will have knowledge about coordination polymers. • 2. Learn the synthesis methods of coordination polymers. • 3. Learn the preparation and characterization of coordination polymers with different ligands. • 4. Learn about the use of coordination polymers in different areas. • 5. Learn about current studies on coordination polymers.					
Course Basic and Auxiliary Contexts		• Suzanne M. Neville, David R Turner, Stuart R. Batten, Coordination Polymers.Design, Analysis and Application. Royal Society of Chemistry, Cambridge 2008. • Mao-Chun Hong, Ling Chen, Design and Construction of Coordination Polymers, John Wiley & Sons, Inc., Hoboken, New Jersey, USA, 2009. • Lecture notes Tunalı N., Özkar S., Anorganik Kimya, Gazi Kitapevi, 2005.					

Methods of Give a Lecture	Face-to-Face and Digital Platform

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Coordination polymers definition and synthesis methods
2	Classification according to bonding forms
3	Supramolecular isomerism
4	Building blocks
5	Solvent effect
6	Guest-host structures, Complementary anions
7	Weak intramolecular and intermolecular interactions
8	**Midterm Exam**
9	Transition metal coordination polymers
10	Bridging ligands
11	Properties of neutral and ionic auxiliary ligands
12	Areas of use of coordination polymers.
13	Areas of use of coordination polymers.
14	Areas of use of coordination polymers.

COURSE IDENTIFICATION FORM

Course Code and Name: KT6035-Symmetry and Group Theory in Molecules				**Department of** : Institute of Graduate Education – Department of Chemical Technologies –PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Ragıp ADIGÜZEL				**Mail :**radiguzel@munzur.edu.tr **Web :** www.munzur ed.tr	
Course Assistant		None				**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		• To provide students with an understanding of the fundamentals of molecular symmetry and to teach the application of group theory to molecular orbital theory, vibrational spectroscopy, crystal structures and ligand field theory.					
Course Goals		To be able to make predictions about the behavior of matter with the molecular symmetry approach To be able to show symmetry operations on some compounds with the molecular model To be able to make symmetry applications related to hybridization, molecular orbitals and molecular motions using group theory					
Course Learning Outs and Proficiencies		1. Knows the symmetry elements and symmetry operations, determines the symmetry point groups of molecules. 2. Creates character tables. 3. Explains the relationships between the symmetry properties of molecules and their polarity and chirality. 4. Finds the hybridization types of molecules and molecular orbitals using symmetry and group theory.					
Course Basic and Auxiliary Contexts		1. Kimyasal Yaklaşımla Simetri ve Grup Teoriye Giriş, Halis Ölmez, Hasan İçbudak, MKM yayıncılık, 2012. 2. Cemal Kaya, Duran Karakaş, Moleküler Simetri, Palme yayıncılık, 2010. 3. A. Vincent, "Molecular Symmetry and Group Theory" Second Edition, 2001, John Wiley & Sons. 4. A. M. Lesk, "Introduction to Symmetry and Group Theory for Chemists" Second Edition, 2001, John Wiley & Sons.					
Methods of Give a Lecture		Face to Face and Digital Platform					

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Simetri kavramı simetri elemanları ve simetri işlemleri
2	Simetri elemanları ve simetri işlemleri
3	Nokta grupları ve bulunuşu
4	Nokta grupları ve bulunuşu
5	Simetri İşlemlerinin Sınıflandırılması
6	Grup teoriye giriş ve karakter tabloları
7	Karakter Tablolarının Oluşturulması
8	**Ara Sınav**
9	İndirgenebilir Simetri Gösterimlerinin Oluşturulması ve İndirgenmesi
10	İndirgenebilir Simetri Gösterimlerinin Oluşturulması ve İndirgenmesi
11	Simetriye göre polarlık ve Kirallik
12	Hibritleşme ile ilgili simetri uygulamaları
13	Molekül orbitalleriyle ilgili simetri uygulamaları
14	Molekül Hareketleri ile ilgili simetri uygulamaları

COURSE IDENTIFICATION FORM

Course Code and Name: KT6045-Inorganic Polymers				**Department of :** Institute of Graduate Education – Chemical Technologies - PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Gülben TORĞUT				**Mail :** gtorgut@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		1. To teach the experimental processes of basic polymerization techniques to students who will receive postgraduate education in this program. 2. To mechanistically examine various polymerization reactions and to characterize the final polymers in detail.					
Course Goals							
Course Learning Outs and Proficiencies		1. Learning the synthesis methods of different polymers in practice 2. Learning the spectroscopic characterization methods of polymers 3. Learning the chemical characterization methods of polymers 4. Learning the thermal characterization methods of polymers 5. Learning the mechanical characterization methods of polymers					
Course Basic and Auxiliary Contexts		• Lecture notes • Y. Sarıkaya “Fizikokimya” 3. Baskı, Gazi Kitabevi, Ankara, 2000. • P.W Atkins, “Physical Chemistry” Sixth Edition, Oxford University, 1998.					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Polimer sentez ve karakterizasyonuna giriş
2	Kuantum mekaniği yöntemleriyle iletken polimerlerin elektrik ve optik özelliklerinin hesaplanması
3	Stiren'in Emülsiyon ve süspansiyon polimerizasyonu
4	FTIR spektroskopisi, ultraviyole spektroskopisi
5	NMR spektroskopisi
6	Termal analiz, DSC, TGA
7	Sulu sistemlerde redoks polimerizasyonu ve Dinsmik mekanik analiz
8	**Ara sınav**
9	Floresans spektroskopisi
10	Polimerlerin mekanik özellikleri
11	Jel geçirgenlik kromatografisi
12	Kondenzasyon Polimerleşmesi-Fenol Formaldehit reçineleri
13	Elektropolimerleşme: İletken polimerler
14	Polimerik malzemelerin akış özelliklerinin incelenmesi

COURSE IDENTIFICATION FORM

Course Code and Name:6037-Polymer Characterization I				**Department of :** Institute Of Graduate Education – Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor	Assist. Prof. Dr. Esra BARIM					**Mail :**esrabarim@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	Providing detailed information on the characterization of polymers, various purification techniques, characterization techniques and examination of the final properties of the product.						
Course Goals							
Course Learning Outs and Proficiencies	1. Have the ability to apply the obtained theoretical knowledge in laboratory, know the use of laboratory techniques in chemical analysis and the basic and practical aspects of chemical analysis. 2. Interpret the accuracy and precision of experimental information. 3. Have the ability to analyze and interpret experimental data with spectroscopic methods.						
Course Basic and Auxiliary Contexts	• 1. Polimer Kimyası, Prof. Dr. Mehmet SAÇAK, Gazi Kitabevi, 2004, • 2. Polymer Characterisation, Hunt-James, Blackie Academic and Professional, London,1993, • 3. Polimer Kimyası, Prof. Dr. Güneri AKOVALI, Ankara,Polymer Spectroscopy, Allan H. Fawcett, John Wiley and Sons, NY, 1997. • Textbook						
Methods of Give a Lecture	Face-to-Face and Digital Platform						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**20**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		**30**
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Karakterizasyon teknikleri
2	Polimerlerde molekül kütlesi
3	Molekül kütlesi dağılımı ve belirleme yöntemleri
4	Uç grup analizleri
5	Kolligatif özellikler
6	Işık saçılması
7	Diffüzyon
8	**Ara sınav**
9	Ultrasantrifüj, sedimantasyon dengesi ve sedimantsyon hızı
10	Viskozimetri
11	GPC yöntemleri
12	Polimerlerin termal karakterizasyonu, DTA
13	DSC
14	TGA. Dinamik ve mekanik termal analiz. Dinamik ışık saçılımı

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COURSE IDENTIFICATION FORM

Course Code and Name:6038-Polymer Characterization II				**Department of :** Institute Of Graduate Education – Chemical Technologies – PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
¤ **Prerequisite (s)**		-					
Instructor		Assist. Prof. Dr. Esra BARIM				**Mail :**esrabarim@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant		-				**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		To examine advanced characterization techniques of polymers.					
Course Goals							
Course Learning Outs and Proficiencies		1. Has the ability to analyze and interpret experimental data using spectroscopic methods. 2. Conducts research and examination in the field of chemical technology, gains the ability to access information and use all kinds of databases. 3. Has the ability to apply the basic rules of chemistry to current issues.					
Course Basic and Auxiliary Contexts		• Polymer characterization, B.J. Hunt, M.I. James, Blackie academic, NY, 1993					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**20**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		**30**
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Spectroscopic characterization, ultraviolet spectroscopy and its application to polymers
2	Fourier transform infrared spectroscopy and its application to polymers
3	^{1}H and ^{13}C-NMR spectroscopy and its application to polymers
4	^{1}H and ^{13}C-NMR spectroscopy and its application to polymers
5	Raman spectroscopy
6	Electron spectroscopy for chemical analysis (ESCA)
7	Electron spectroscopy for chemical analysis (ESCA)
8	**Midterm exam**
9	Use of electron spin resonance in the characterization of polymerization and polymer
10	Use of X-ray diffraction in the characterization of polymers
11	Crystallinity of polymers, mechanical characterization
12	Microscopic characterization Light microscopy
13	Scanning electron microscopy (SEM)
14	Atomic force microscopy (AFM)

COURSE IDENTIFICATION FORM

Course Code and Name: KT6039-Polymer Composites				**Department of :** Institute of Graduate Education – Chemical Technologies - PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Assoc. Prof. Dr. Nedim GÜRLER				**Mail :** nedimgurler@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					

Course Aim	• To teach the preparation and characterization of polymer composites and mixtures • To teach the application areas of polymeric materials • To examine current studies on polymer composites and nanocomposite films or products
Course Goals	To provide students with competence in the production and characterization of polymer composites.
Course Learning Outs and Proficiencies	• At the end of this course, students will have information about polymer composites and blends. • Learn the production of polymer composites. • Learn the preparation and characterization of nanoadditive polymers. • Learn the use of polymer composites in different areas. • Learn the preparation and application areas of biocomposite and nanocomposite films. • Learn about thermoplastic and thermoset composites. • Learn about current studies on polymer composites.
Course Basic and Auxiliary Contexts	• Saçak M., Polimer Teknolojisi, Gazi Kitapevi, Ankara, 2017. • Taşdemir, M., Plastik Malzemelerin Test Teknikleri, Seçkin Yayınevi, 2018 • Lecture notes
Methods of Give a Lecture	Face-to-Face and Digital Platform

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Introduction to polymers
2	Production, characterization, physical, mechanical and application areas of polymer blends
3	Preparation and production of polymer composites
4	Application areas of polymer composites
5	Mechanical properties of polymer composites
6	Stress and strain curves in polymers
7	Thermoplastic, thermoset and elastomer materials
8	Polymer composites obtained from renewable resources and their application areas
9	Production and properties of chitosan and cellulose based composites
10	Production and properties of starch based composites
11	Physical properties of polymer composites
12	Physical properties of polymer composites
13	Production and characterization of nano-filled polymer nanocomposites
14	Production, physical and mechanical properties of plant oil extract added composite materials

COURSE IDENTIFICATION FORM

Course Code and Name: KT6040-Advanced Heat Transfer				**Department of : Department of Chemical Technologies-PhD Program**			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor	Assoc. Prof. Dr. Hakan YOĞURTÇU					**Mail :**hakanyogurtcu@ munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	Investigation of heat transfer mechanisms and presentation of analytical and numerical solution approaches for steady and unsteady conditions for one, two and three dimensional systems.						
Course Goals	•						
Course Learning Outs and Proficiencies	• Learn advanced heat transfer approaches and different heat transfer mechanisms and gain problem solving skills.						
Course Basic and Auxiliary Contexts	• Holman, Heat Transfer • Kakaç, S.,Yener, Y., Heat Conduction • Bird, R.B., Steward, W.E., Lightfoot, E.N., Transport Phenomena						
Methods of Give a Lecture	Face-to-Face and digital platform supported						

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**15**
	2. Quiz	**X**	**15**
	3. Quiz	**X**	**15**
	4. Quiz	**X**	**15**
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**40**

Semester Course Plan

Week	Subjects
1	Conduction heat transfer. Derivation of one-dimensional, two-dimensional, three-dimensional heat transfer equations (steady state)
2	Conduction heat transfer. Derivation of one-dimensional, two-dimensional, three-dimensional heat transfer equations (non-steady state)
3	Conduction heat transfer. Derivation of one-dimensional, two-dimensional, three-dimensional heat transfer equations (non-steady state)
4	Analytical solution methods of conduction problems in steady and unsteady conditions
5	Analytical solution methods of conduction problems in steady and unsteady conditions
6	Convection heat transfer, Natural convection
7	Convection heat transfer, Forced convection
8	Convection heat transfer, Forced convection
9	Thermal radiation
10	Boiling and condensation
11	Thermal boundary layer problems
12	Thermal boundary layer problems
13	Approximate solution of heat transfer problems by finite difference method
14	Approximate solution of heat transfer problems by finite difference method

COURSE IDENTIFICATION FORM

Course Code and Name: KT6041- Organometals Chemistry				**Department of :** Institute of Graduate Education- Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Ragıp ADIGÜZEL				**Mail :**radiguzel@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim	• To teach how to define coordination compounds and determine the physical and chemical properties of the molecular structures that form these compounds.						
Course Goals							
Course Learning Outs and Proficiencies	• When the course is completed, students will be able to formulate, name and describe the structural properties of coordination compounds, • Have extensive knowledge of bonding theories and explain the bond formation of compounds, • Know the coordination compounds used in daily life and industry.						
Course Basic and Auxiliary Contexts	• Gary L. Miessler, Donald A Tarr, İnorganik Kimya, Üçüncü Baskıdan Çeviri Editörleri: Nurcan Karacan, Perihan Gürkan, Palme Yayıncılık, Ankara, 2009. • Cemal Kaya, İnorganik Kimya, Cilt 2, 3. Baskı, Palme Yayıncılık, Ankara, 2011. • Namık K. Tunalı, Saim Özkar. İnorganik Kimya, Gazi Üniversitesi Yayınları, 1993, Ankara. • Tunalı, N., Özkar, S., Anorganik Kimya, Gazi Kitapevi, 2005.						
Methods of Give a Lecture							

	Face-to-Face and digital platform

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Definition of coordination compound, examples in life and industry
2	Werner Theory
3	Formulation and naming of coordination compounds
4	Isomerism
5	Coordination numbers and structures
6	VSEPR theory
7	Coordinative bonds; Molecular Orbital theory
8	Molecular Orbital theory **Midterm exam**
9	Valence bond theory
10	Crystal-field theory
11	Ligand-field theory
12	Ligand types and properties
13	Areas of use of coordination compounds
14	Areas of use of coordination compounds

COURSE IDENTIFICATION FORM

-Course Code and Name: KT6042-Fundamentals of Advanced Analytical Chemistry-I	**Department of :** Institute Of Graduate Education – Chemical Technologies -PhD Program

Semester	Theoretic Hour	Practice Hour	Total Hour	Credits	ECTS	Education Language	Type: Compulsory Elective
Fall/Spring	3	0	3	3	5	Turkish	Optional

Prerequisite (s)		
Instructor	Associate professor Berna KOÇAK	**Mail :bernakocak@munzur.edu.tr** **Web :**www.munzur.edu.tr
Course Assistant		**Mail :** **Web :**
Groups / Classes	PhD	
Course Aim	To provide students with the basic knowledge and concepts necessary to perform qualitative and quantitative chemical analyses.	
Course Goals		
Course Learning Outs and Proficiencies	• Learning all kinds of concentration units • Learning to prepare solutions • Learning to evaluate analytical data • Learning acid-base balances • Learning to draw acid-base titration curves	
Course Basic and Auxiliary Contexts	Skoog, D.A., West D.M., Holler, F.J (trans. Kılıç, E, Köseoğlu, F.) (1996). Fundamentals of Analytical Chemistry, 7th Edition. Ankara: Bilim Publishing. Lee, J:	
Methods of Give a Lecture	Face to Face and Digital Platform	

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction to chemical analysis
2	Errors in chemical analysis
3	Random errors in analysis
4	Application of statistics in the analysis and evaluation of data
5	Solutions and solution concentrations
6	Solutions and solution concentrations
7	Chemical equilibrium, equilibrium constant, systematic solution in equilibrium systems
8	**Midterm exam**
9	Strong acids and bases and titration curves
10	Buffer solutions
11	Complex acid-base systems
12	Titration curves of complex acid-base systems
13	Buffer solutions obtained from complex acid-base systems
14	Final exam

COURSE IDENTIFICATION FORM

-Course Code and Name: KT6043 -Fundamentals of Advanced Analytical Chemistry II				**Department of :** Institute f Graduate Education – Chemical Technologies - PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)		-					
Instructor		Associate professor Berna KOÇAK				**Mail :bernakocak@munzur.edu.tr** **Web :**www.munzur.edu.tr	
Course Assistant		-				**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		To provide students with the basic knowledge and concepts necessary to perform qualitative and quantitative chemical analyses.					
Course Goals							
Course Learning Outs and Proficiencies		To provide basic information for theoretical approaches in solving problems related to precipitation, complexation and reduction-oxidation equilibria. To learn the basic concepts required for the methods to be selected in real sample analyses.					
Course Basic and Auxiliary Contexts		Skoog, D.A., West D.M., Holler, F.J (trans. Kılıç, E, Köseoğlu, F.) (1996). Fundamentals of Analytical Chemistry, 7th Edition. Ankara: Bilim Publishing. Lee, J:					
Methods of Give a Lecture		Face to Face and Digital Platform					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Aqueous solutions and chemical equilibrium, application of equilibrium constants and solubility product constants, solubility and common ion effect.
2	Effect of electrolytes on solubility balances, Ionic strength, activity coefficients, Dbye-Hückel equation.
3	Solution of solubility balance problems in complex systems and solubility calculations, mass and charge balances, effect of pH on solubility.
4	Solubility of precipitates in the presence of complexing reagents, separation of ions by controlling the precipitant concentration, separations with sulfur
5	Gravimetric analysis methods, properties of precipitate, coagulation of colloids, crystal formation, calculation of results from gravimetric data,
6	Precipitation titrimetry, titration curves with titrimetric methods, precipitation titrations with silver, precipitation indicators, Mohr, Volhard.
7	Complexation titrations, complex formation, titrations with inorganic and organic complexing agents, introduction to EDTA titrations.
8	Midterm exam
9	Structure and properties of EDTA. Calculation of α4 values, EDTA titration curves, other complex effects, calculation of αM.
10	Indicators for EDTA, titration methods with EDTA, direct, reverse and displacement titrations, EDTA titration scope, hardness in water.

11	Introduction to electrochemistry, electrochemical cells and their types, electrode potentials, Nernst equation and limitations, formal potential.
12	Applications of standard potentials, calculation of E(cell), calculation of redox, formation and solubility equilibrium constants.
13	Electrode potentials in redox titrations, redox titration curves, redox indicators.
14	Applications of redox titrations, auxiliary reducing and oxidizing agents, adjustment of $KMn0_4$ and titration applications, iodometric titration.

COURSE IDENTIFICATION FORM

Course Code and Name: KT6044 Electrochemistry				**Department of :** Institute Of Graduate Education – Chemical Technologies - PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Associate professor Berna KOÇAK				**Mail :**bernakocak@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		Understand electrochemical systems, learn research methods, and evaluate results					
Course Goals							
Course Learning Outs and Proficiencies		To learn basic electrochemical information and analysis techniques that are valid for this information. To learn the information to evaluate the data obtained from electrochemical techniques.					
Course Basic and Auxiliary Contexts		Skoog, D.A., West D.M., Holler, F.J (trans. Kılıç, E, Köseoğlu, F.) (1996). Fundamentals of Analytical Chemistry, 7th Edition. Ankara: Bilim Publishing. Lee, J:					
Methods of Give a Lecture		Face to Face and Digital Platform					

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	What is electrochemistry? What are the cell types? Explanations
2	Determination of Cell Potential, Anode-Cathode potentials, liquid contact potential
3	Intracellular resistance drop, Polarization effects
4	What are the electrode types? Standard Hydrogen, Calomel andAg/AgCl reference electrodes
5	Working electrodes: Metal, membrane (glass, liquid and solid state) electrodes, pH electrodes
6	Potentiometric Method: Direct and titration technique
7	Conductometric Method
8	Midterm exam
9	Electro gravimetric Method
10	Introduction to Voltammetric Methods, Polarography, its development and types
11	Mathematical modeling of Polarography and qualitative-quantitative applications
12	Amperometric Titration, Chronoamperometry
13	Coulometry at Constant Potential
14	Overall evaluation

COURSE IDENTIFICATION FORM

Course Code and Name: KT6045-Inorganic Polymers				**Department of :** Institute of Graduate Education – Chemical Technologies - PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Ragıp ADIGÜZEL				**Mail :** radiguzel@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		To provide information about the structural properties and usage areas of inorganic polymers.					
Course Goals							
Course Learning Outs and Proficiencies		When the course is completed, students will be able to distinguish the differences between inorganic polymers and other polymers, Learn the synthesis methods and bonding methods of polymers, Recognize the areas where inorganic compounds are used in industry.					
Course Basic and Auxiliary Contexts		• Stuart R. Batten, Coordination Polymers Design, Analysis and Application, 2009. • Atkins, S., Inorganic Chemistry, Oxford Univercity Press, 1999. • Miessler, G. L., Tarr, D. A., İnorganik Kimya, Palme Yayınları, 2002. • Yayınlanmış bilimsel makaleler					
Methods of Give a Lecture		Face-to-Face and Digital Platform					

		If Available, to Sign (x)	General Average Percentage (%) Rate
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Definition of inorganic polymers and differences from other polymers
2	Synthesis methods
3	Classification according to bonding types
4	Supramolecular isomerism
5	Building blocks
6	Guest-host structures, Complementary anions
7	Intramolecular and intermolecular interactions
8	**Midterm Exam**
9	Transition metal inorganic polymers
10	Ligand and its types
11	Industrial uses of inorganic polymers
12	Industrial uses of inorganic polymers
13	Industrial uses of inorganic polymers
14	Industrial uses of inorganic polymers

COURSE IDENTIFICATION FORM

Course Code and Name: KT6046-Inorganic Reaction Mechanism				**Department of :** Institute of Graduate Education-Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Ragıp ADIGÜZEL				**Mail :**radiguzel@munzur.edu.tr **Web :**www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim	• To have an idea about whether a reaction is theoretically thermodynamically and kinetically stable and through which mechanism the reaction can occur by taking into account complex reactions and reaction mechanisms.						
Course Goals							
Course Learning Outs and Proficiencies	• Upon completion of this course, students; can judge whether a reaction is thermodynamically stable and kinetically labile or inert, • To be able to comment on the mechanism by which a reaction will take place theoretically, taking into account complex reactions and reaction mechanisms, • Interpret the concept of trans effect on square plane substitution reactions, taking into account the properties of ligands.						
Course Basic and Auxiliary Contexts	• Gary L. Miessler, Donald A Tarr, İnorganik Kimya, Üçüncü Baskıdan Çeviri Editörleri: Prof. Dr. Nurcan Karacan, Prof. Dr. Perihan Gürkan, Palme Yayıncılık, Ankara, 2009. • Cemal Kaya, İnorganik Kimya, 3. Baskı Cilt 2, Palme Yayıncılık, Ankara, 2011. • M.L. Tobe, Reaction mechanism in inorganic chemistry, Butterworths, london, 1952. • L. William,M.C. Jolly, Modern Inorganic Chemistry Craw Hill.inc., New York, 1991.						

Methods of Give a Lecture	Face-to-Face and Digital Platform

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Homework (Ten)		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	1. Chemical kinetics: Rate laws, integrated rate equations, Activation parameters
2	2. Basic concepts, Stability and inertness
3	3. Kinetic techniques, Classification of mechanisms
4	4. Kinetic consequences of reaction pathways: dissociation, interchange, association
5	Substitution Reactions in Square Plane Complexes, Trans Effect, Other Effects Affecting Substitution Reaction Rate, Substitution Reactions in Tetrahedral Complexes
6	Substitution Reactions in Square Plane Complexes, Trans Effect, Other Effects Affecting Substitution Reaction Rate, Substitution Reactions in Tetrahedral Complexes
7	Substitution in regular octahedral complexes, Kinetics, Mechanisms, Leaving Group Effects
8	Substitution in regular octahedral complexes, Kinetics, Mechanisms, Leaving Group Effects, Coordinated water displacement **Midterm exam**
9	Chelate and ligand effects, Metal Effect
10	Acid and Base Catalysis, Stereochemistry of Octahedral Substitution reactions
11	Organometallic Substitution Reactions, Ligand Bonds, Metal Carbonyl Substitution Reactions, Metal Effects on Reactivity
12	Organometallic Substitution Reactions, Ligand Bonds, Metal Carbonyl Substitution Reactions, Metal Effects on Reactivity
13	Synthesis of coordination compounds using substitution reactions
14	Thermodynamic stability of coordination compounds

COURSE IDENTIFICATION FORM

Course Code and Name: KT6047- Advanced Kinetic				**Department of :** Institute of Graduate Education- Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor	Prof. Dr. Aslışah AÇIKSES					**Mail :**aslisahacikses@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	• The aim of this course is to provide basic information on advanced kinetics to graduate students.						
Course Goals							
Course Learning Outs and Proficiencies	• When this course is completed, students will be able to; Kinetics, reaction rate, order, molecularity, types of order and how to find order on a reaction. • Predict how a reaction will be affected by temperature. • Reach the capacity to write a rate expression for a reaction by determining reaction mechanisms.						
Course Basic and Auxiliary Contexts	• P. W. Atkins; Physical Chemistry;1998 • CEBE. M. ;Fizikokimya;1987 • HURLY M. ;Chemistry (Principles and Reactios);1989						
Methods of Give a Lecture	Face-to-Face and Digital Platform						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Kinetics
2	Reaction Rate
3	Factors Affecting Reaction Rate
4	Reaction Order
5	Methods for determining reaction order
6	Methods for determining reaction order
7	Methods for determining reaction order
8	**Midterm Exam**
9	Effect of temperature on reaction rate (Arrhenius Relation)
10	Chemical Reactions (Collision Theory)
11	Reaction Mechanisms
12	Reaction Mechanisms
13	Application of These Theories on Reaction Rate
14	Application of These Theories on Reaction Rate

COURSE IDENTIFICATION FORM

Course Code and Name: KT6048- Colloid Chemistry				**Department of :** Institute of Graduate Education-Department of Chemical Technologies- PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)							
Instructor		Prof. Dr. Aslışah AÇIKSES				**Mail :**aslisahacikses@munzur.edu.tr **Web :** www.munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim	• The aim of this course is to provide basic information on colloids to graduate students.						
Course Goals							
Course Learning Outs and Proficiencies	• When this course is completed, students will be able to see that; There are intermediate mixtures between real solutions and heterogeneous mixtures, particles are suspended in the solution, The main feature that distinguishes colloidal solutions from other solutions is the size of these particles. The particle size of the dispersed phase is around 1-1000 nm. • They will be able to easily express terms such as sol, aerosol and emulsion. • They will be able to use methods such as ultracentrifugation, osmotic pressure, turbidity and viscosity in addition to the microscope method to determine the size of colloidal particles.						
Course Basic and Auxiliary Contexts	• Prof. Dr. A. Tevfik; Kolloit Kimyası: • Prof. Dr. C. Mustafa; Fiziko Kimya;1987 • P. W. Atkins.; Physical Chemistry;1998 • Genel Kimya 1, İlkeler ve Modern Uygulamalar, Petrucci, Harwood, Herring, • Çeviri Editörleri: Tahsin Uyar, Serpil Aksoy,10. Baskı, Palme Yayıncılık, Ankara, 2010						
Methods of Give a Lecture							

	Face-to-Face and Digital Platform

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Introduction to colloid chemistry
2	Methods of obtaining colloids
3	Particle shapes of colloids
4	Fine filtration and semipermeable purification
5	Movement of colloids
6	Optical properties of colloids
7	Viscosity
8	**Midterm Exam**
9	Surface tension
10	Tyndall effect
11	Adsorption of colloids
12	Electrical properties of colloids
13	Formation of sol-gel
14	Formation of sol-gel

COURSE IDENTIFICATION FORM

Course Code and Name: KT6049-Antimicrobial Polymers				**Department of :** Department of Chemical Technologies PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)		-					
Instructor		Assoc. Prof. Güzin PIHTILI YILDIZ				**Mail :** gpihtili@munzur.edu.tr **Web :**www. munzur.edu.tr	
Course Assistant		-				**Mail :** **Web :**	
Groups / Classes		PhD					
Course Aim		Antimicrobial natural polymers (antimicrobial peptides); Explain the synthesis, characterization, structure and industrial application of antimicrobial polymers.					
Course Goals		• Basic requirements for antimicrobial polymers • Antimicrobial natural polymers (structure and properties of peptides) • Synthesis and characterization of antimicrobial polymers. • Biocidal cationic polymers (synthesis and characterization of polymers containing pyridine, guanidine, amine salts) • Synthesis of Ag^+, TiO_2, ZnO based antimicrobial nanoparticles, • Examination of the bactericidal antimicrobial polymer mechanism (instrumental analysis methods such as fluorescence spectroscopy, confocal microscopy, DLS techniques used to examine the interaction of polymers with the bacterial wall model, synthetic lipid globules and real bacterial wall) • Sterile surface preparation and industrial applications (water treatment, food packaging, implant materials, textile products, paint, etc.)					
Course Learning Outs and Proficiencies		• Öğrenci antimikrobiyal doğal ve sentetik polimerler hakkında bilgi edinir. • Öğrenci antimikrobiyal polimerlerin sentezi ve karakterizasyonu kapsamında bilgi edinir. • Öğrenci doğal peptit türevlerine benzer sentetik oligomer ve polimerler (amfifilik yapı özelliği, hidrofobik/hidrofilik oranının önemi, yapı/aktivite ilişkisi) kapsamında bilgi edinir. • Öğrenci antimikrobiyal nanopartiküller (Ag^+, TiO_2, ZnO esaslı nanopartiküllerin sentezi, polimer-nanopartikülkolloidal yapılarının sentezi ve yüzey uygulamaları) kapsamında bilgi edinir.					

	• Öğrenci bakteri-antimikrobiyal polimer mekanizmasının incelenmesinde kullanılan enstrümantal teknikler hakkında bilgi edinir. • Öğrenci steril yüzey hazırlanması ve endüstriyel uygulamalar kapsamında bilgi edinir
Course Basic and Auxiliary Contexts	• • Bryskier, A. (Ed.). (2005). Antimicrobial Agents: Antibacterial and Antifungals. Washington DC: ASM Press. • Jones, D. (2010). The antibacterial lead discovery challenge. Nature Reviews Drug Discovery, 9(10), 751-752. • Saif, M.J.; Anwar, J. & Munawar, M.A. (2009). A Novel Application of Quaternary Ammonium Compounds asAntibacterial Hybrid Coating on Glass Surfaces. Langmuir, 25(1), 377-379 • Prncples of Polymerzaton, 4th edton (G. Odan, John Wley), • Antimicrobial Polymers 1st Edton,(Jose Mara Lagaron, Mara Jose Oco,Amparo Lopez-Rubo) John Wley), Brysker, A. (Ed.). (2005). • Antimicrobial Agents: Antibacterial and Antifungals. Washngton DC: ASM Press, Polymers for Bomedcal Applcatons (Anl Mahapatro, Ankur S. Kulshrestha) OUP USA, 2008, Antimicrobial Polymers. Jose Mara Lagaron,Mara Jose Oco, Amparo Lopez-Rubo. Wley.
Methods of Give a Lecture	Face to face

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		

	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	Overview of antimicrobial polymers
2	Antimicrobial natural polymers I
3	Antimicrobial natural polymers II
4	Synthesis and characterization of antimicrobial polymers
5	Synthesis and characterization of antimicrobial polymers
6	Synthesis and characterization of antimicrobial polymers
7	Synthetic oligomers and polymers similar to natural peptide derivatives I (amphiphilic structure feature, importance of hydrophobic/hydrophilic ratio, structure/activity relationship)
8	**Midterm Exam**
9	Synthetic oligomers and polymers II similar to natural peptide derivatives (amphiphilic structure feature, importance of hydrophobic/hydrophilic ratio, structure/activity relationship)
10	Antimicrobial nanoparticles I (Synthesis of Ag+, TiO_2, ZnO based nanoparticles, synthesis of polymer/nanoparticle colloid structures and surface applications) I
11	Antimicrobial nanoparticles II (Synthesis of Ag+, TiO_2, ZnO based nanoparticles, synthesis of polymer/nanoparticle colloid structures and surface applications) II
12	Investigation of bacterial / antimicrobial polymer mechanism I
13	Investigation of bacterial / antimicrobial polymer mechanism II
14	Industrial applications of antimicrobial polymers (such as water treatment, food packaging, implant materials such as catheters, textiles, paint)

COURSE IDENTIFICATION FORM

Course Code and Name: KT6050-Conductive Polymers				**Department of :** Department of Chemical Technologies PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	No						
Instructor	Assoc. Prof. Güzin PIHTILI YILDIZ					**Mail :** gpihtili@munzur.edu.tr **Web :** www. munzur.edu.tr	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	Recognizing conductive polymers, which have gained great importance with both academic and commercial applications in recent years, and examining the application areas of conductive polymers. .						
Course Goals	• Introduction to Conductive Polymers, • Classification of electrochemically active polymers, • Electrical and Electrochemical Properties of Conductive Polymers, • Doping and conductivity properties, • Solubility of Conductive Polymers, • Characterization of Conductive Polymers • Conductivity Measurement Techniques, Synthesis methods of Conductive Polymers, • Application Areas of Conductive Polymers						
Course Learning Outs and Proficiencies	1. It plays a role in production and development in all areas related to chemistry. 2. Uses technologies effectively in solving problems in the field of chemistry. 3. To learn the application areas of conductive polymers						

Course Basic and Auxiliary Contexts	Stuart R. Batten, Coordination Polymers Design, Analysis and Application, 2009. • Atkins, S., Inorganic Chemistry, Oxford University Press, 1999. • Miessler, G. L., Tarr, D. A., Inorganic Chemistry, Palme Publications, 2002. • Published scientific articles
Methods of Give a Lecture	1.Conductng Polymers, G.Inzelt,F.Scholz,Sprnger,2008 2.Handbook of Conductand Polymers Conjugated polymers, T.A. Skotherm, J.R. Reynolds, CRC Press,2006.

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Introduction to Conductive Polymers
2	• Classification of electrochemically active polymers
3	• Electrical and Electrochemical Properties of Conductive Polymers
4	• Conductivity theory and conductivity in conductive polymers
5	• Doping and conductivity property
6	• Solubility of Conductive Polymers
7	• Characterization of Conductive Polymers
8	• Midterm Exam
9	• Synthesis methods of Conductive Polymers

10	• Conductivity Measurement Techniques
11	• Homework presentation
12	• Application Areas of Conductive Polymers
13	• Application Areas of Conductive Polymers
14	• Application Areas of Conductive Polymers

COURSE IDENTIFICATION FORM

Course Code and Name: KT6051-Polymer Production and Processing				**Department of :** Department of Chemical Technologies PhD Program			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	5	Turkish	Optional
Prerequisite (s)	No						
Instructor	Assoc. Prof. Güzin PIHTILI YILDIZ					**Mail : gpihtili@munzur.edu.tr** **Web : www.munzur.edu.tr**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes	PhD						
Course Aim	• In this course, the main production techniques used in the commercial scale production of polymers in laboratories and industry, • To be informed about the molding methods used to make the obtained polymers suitable for human use. • Will have information about the technological properties, polymerization processes, fabrication processes, commercial production techniques of commercially important polymers and molding techniques that make them available to the market as desired objects.						
Course Goals	• Students will be provided with a knowledge base in the field of developing polymer technology.						
Course Learning Outs and Proficiencies	• 1. The importance of polymers • 2. Technological properties of polymers • 3. Polymerization processes • 4. Fabrication processes • 5. Commercial polymers properties. • 6. Processing of plastics • 7. Processing of fibers • 8. Elastomers						

Course Basic and Auxiliary Contexts	• S. Basan Polimer "Üretimi ve İşlemeciliği" Ders Notları, Çorum 2014. Kaynaklar • M.Saçak, Polimer Teknolojisi, Gazi Kitabevi, Ankara, 2005. ISBN: 975-8895-82-6 • Ö.Tunç Savaşçı, N.Uyanık, G.Akovalı Plastikler ve Plastik Teknolojisi, Çantay Kitabevi,1998. ISBN: 975-7206-26-
Methods of Give a Lecture	Face to Face and Digital Platform

		If Available, to Sign (x)	**General Average Percentage (%) Rate**
Assessment Criteria	**1. Quiz**	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	**Subjects**
1	Introduction to Polymers: Basic Concepts and Definitions, The Place and Importance of Polymers in Our Life, Chemical Structure and Classification of Polymers
2	Polymerization Mechanisms
3	Polymer Production Methods
4	Polymer Production Methods
5	Physical, Chemical, Mechanical, Thermal, Rheological and Morphological Properties of Polymers, Structure-Property Relationship
6	Characterization Methods Applied to Polymers
7	Thermoplastic Materials: Structures and Properties, Important Industrial Thermoplastics and Uses

8	**Midterm**
9	Thermoset Materials: Structures and Properties, Important Industrial Thermoset Polymers and Their Uses
10	Thermoset Materials: Structures and Properties, Important Industrial Thermoset Polymers and Their Uses
11	Elastomeric Materials and Fibers: Structures, Properties and Uses, Important Industrial Elastomers
12	Methods of Forming Polymeric Materials
13	Polymeric Composite Materials: Classification, Preparation Methods, Application Areas
14	Polymeric Composite Materials: Classification, Preparation Methods, Application Areas

COURSE IDENTIFICATION FORM

Course Code and Name: KT6052/ Spectroscopic Methods				**Department of :** Department of Chemical Technologies Master's Program with Thesis			
Semester	**Theoretic Hour**	**Practice Hour**	**Total Hour**	**Credits**	**ECTS**	**Education Language**	**Type: Compulsory Elective**
Fall/Spring	3	0	3	3	6	Turkish	Optional
Prerequisite (s)		-					
Instructor		Ass. Prof. Güzin PIHTILI YILDIZ				**Mail : gpihtili@munzur.edu.tr** **Web :**	
Course Assistant						**Mail :** **Web :**	
Groups / Classes							
Course Aim	To provide students with the principles and concepts of basic spectroscopic techniques used to determine the structure of compounds.						
Course Goals	Acquisition of basic information, theoretical aspects, practical examples and applications of UV/Vis Spectroscopy • Acquisition of basic information, theoretical aspects, practical examples and applications of Infrared (IR) Spectroscopy • Acquisition of basic information, theoretical aspects, practical examples and applications of Nuclear Magnetic Resonance (NMR) Spectroscopy						
Course Learning Outs and Proficiencies	1. Learns the basic information, theoretical aspects, practical examples and applications of UV/Vis Spectroscopy by trying them out 2. Learns the basic information, theoretical aspects, practical examples and applications of Infrared (IR) Spectroscopy by trying them out 3. Learns the basic information, theoretical aspects, practical examples and applications of Nuclear Magnetic Resonance (NMR) Spectroscopy by trying them out.						
Course Basic and Auxiliary Contexts	Fundamentals of Molecular Spectroscopy, C.N. Banwell, McGraw Hill. Introduction to Molecular Spectroscopy, E.F. H. Brittain, W.O. George, C.H. J. Wells, Academic Press. Instrumental Analiz, Prof. Dr. Turgut Gündüz.						
Methods of Give a Lecture	Face to face						

Assessment Criteria		**If Available, to Sign (x)**	**General Average Percentage (%) Rate**
	1. Quiz	**X**	**50**
	2. Quiz		
	3. Quiz		
	4. Quiz		
	5. Quiz		
	Oral Examination		
	Practice Examination (Laboratory, Project etc.)		
	Final Examination	**X**	**50**

Semester Course Plan

Week	Subjects
1	• Basic information of spectroscopy, electromagnetic radiation
2	• Light energy and matter
3	• Spectroscopy Devices
4	• Spectroscopic Methods
5	• Basic principles of spectroscopic methods
6	• Characterization of electromagnetic radiation
7	• UV spectroscopy
8	• Midterm exam
9	• IR spectroscopy
10	• Analysis with IR spectroscopy
11	• Examples of analysis with IR spectroscopy
12	• NMR spectroscopy
13	• Analysis with NMR
14	• Examples on analysis with NMR