KARABÜK ÜNİVERSİTESİ
LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ

DEPARTMENT OF WASTE MANAGEMENT
Content of Doctor of Philosophy Programme in Waste Management

COURSE CODE	COURSE NAME AND CONTENTS	T	A	C	ECTS
SKM803	**Composting Technologies**	3	0	3	8
Purpose and Content	The objective of this course is to examine the principles and practice of modern-day composting, in-depth. At the end of the course, the students will acquire the knowledge to analyze the composting process and the necessary skills to design a functioning composting facility that produce an end product meeting the demanded specifications. Firstly, the historical composting practices will be reviewed and different types of biosolids that can be used in composting process will be discussed. In the following weeks, currently available composting technologies will be the explored and the fundamental principles driving the composting process will be presented, along with the analytical approach to assess the process. In the second part of the course, design and management basics for a composting facility; control methods for odor, bioaerosols, dust emissions from composting plants; and criteria for determination of the maturity and safety of the compost will be taught. Finally, the possible venues for beneficial use of compost will be mentioned.				
SKM839	**Industrial Solid Waste Reclamation**	3	0	3	8
Purpose and Content	The methods that can be applied for beneficially using industrial solid wastes will be shown. The available tools to determine the possible environmental risks and measures that can be taken to minimize these risks will be taught. Information will be given on how fly ash, bottom ash, waste concrete, slags and similar solid industrial wastes can be valorized applying various recovery and beneficial reuse techniques. The chemical properties of these wastes and what kind of components they will leach in contact with water will be explained. Binding legal regulations, test procedures to be followed and how to evaluate test results will be taught.				
SKM836	**Fate and Transport of Pollutants in Nature**	3	0	3	8
Purpose and Content	Understanding the main processes that determine the fate and transport of pollutants in nature is of fundamental importance in assessing and mitigating environmental risks. In this course, the chemical properties of pollutant compounds and how conditions in different environments (atmosphere, surface waters, and soil) affect the movements and physical, chemical, and biological transformations of these compounds will be examined. Students completing this course will learn the distribution of pollutants between phases, transport mechanisms such as diffusion and advection, transformations of pollutants such as photolysis, precipitation, and biodegradation, and predicting concentration profiles of pollutants in specific scenarios.				
SKM813	**Treatment Methods of Hazardous Wastes**	3	0	3	8
Purpose and Content	The aims of this course are : to give some information related to the sources and properties of hazardous wastes, treatment and disposal techniques. Source reduction; reuse and exchange. Integrated management. Risk assessment; doseresponse relationships and models.				
SKM829	**Biosensors**	3	0	3	8

Purpose and Content	The aim of this course are: Introuction of biosensors , working principles, Classification of biosensors, usage areas, use of biosensors in Environmental Engineering, Use of biosensors in agricultural fields, Use of biosensors in medicine, Types of biosensors and General evaluations about the course topics.

SKM835	**Green Design and Production**	3	0	3	8
Purpose and Content	It is aimed to transfer the methods of waste generation before pollution by introducing a new point of view as an alternative to the end of pipe treatment which is included in the environmental engineering as the treatment sense. Pollution prevention and clean production (CP) concepts, CP concept, Comparison of Pollution Prevention and Pollution Control Approaches, Pollution Prevention and CP methods and basic principles, Eco efficiency, International and local legislation on CP, Costs in CP and carbon footprint studies analysis, Life Long Assessment, Clean Production Case Studies in the World				

SKM806	**Thermochemical biomass conversion technologies**	3	0	3	8
Purpose and Content	The aim of the course is to provide fundamentals of conversion technologies, products from thermochemical conversion technologies and their usage. fundamentals of thermochemical conversion technologies, pyrolysis, hydrothermal processing, combustion, gasification.				

SKM837	**Plastic waste management**	3	0	3	8
Purpose and Content	The aim of the course is to give knowledge about plastics, to give information about waste plastics, to give information about management of waste plastics. Plastics, types of waste plastics, sources of waste plastics, management of waste plastics				

SKM838	**Energy generation from wastes**	3	0	3	8
Purpose and Content	The aim of the course is to give knowledge about different processes for energy generation from wastes, to give information about waste types for energy generation, to give knowledge about use of energy from wastes. Waste types, energy, processes for energy generation from waste .				

SKM 841	**Lignocellulosic Bioproducts**	3	0	3	8
Purpose and Content	This lesson aims to describe the chemistry of diferent components of lignocellulosic biomass (cellulose, hemicellulose, lignin, extractives and ash). Besides, many novel industrial applications of lignocellulosic biomass have been comprehensively described, which includes biorefning for biofuel and biochemical production, biomedical, cosmeceuticals and pharmaceuticals, bioplastics, multifunctional carbon materials and other eco-friendly specialty products. The production and applications of lignocellulose-derived carbon materials such as activated carbon, carbon nanotubes, carbon nanohorns, etc. have been highlighted. The potential industrial utility of cellulose and lignin-based specialty materials such as cellulose fber, bacterial cellulose, epoxides, polyolefns, phenolic resins, bioplastics are discussed in this lesson. Lignocellulosic feedstocks are gaining increased popularity for novel industrial applications because of their availability and bio-renewability. Using lignocellulosic materials, especially from agricultural and forestry sectors could help reduce the over dependence on petrochemical resources while providing a sustainable waste management alternative. The cutting-edge industrial utilization of lignocellulosic biomass described in this lesson suggests its major role in establishing				

	a circular bioeconomy that consists of innovative design and advanced production methods to facilitate industrial recovery and reuse of waste materials beyond biofuel and biochemical production.

SKM 840	**Microwave pyrolysis**	3	0	3	8
Purpose and Content	This lesson aims to a state-of-the-art technique regarding the MAP of biomass. The sections from Fundamentals of microwave irradiation to Catalysts for catalytic microwave-assisted pyrolysis are specically given. Owing to the key features of MAP (e.g. rapid volumetric heating, easy control, and energy saving), MAP has as the more effective pathway to valorize biomass than conventional pyrolysis. It is also noticed that the MAP technology is a well established one that can be used to enhance pyrolysis for target products. Several types of catalysts including metal oxides and zeolite-based catalysts have been most commonly employed during the CMAP of biomass, signicantly affecting the product yields, distributions, and even qualities.The increasing demand for renewable fuels and chemicals necessitates the exploration of alternative sources to replace petroleum sources. Biomass has been viewed as the most promising source to produce sustainable fuels and chemicals. Underpinning the key advantages of microwave heating (e.g., rapid and controlled heating, energy saving, and no requirement for agitation or fluidization), microwave-assisted pyrolysis (MAP) is one of the most attractive techniques for the valorization of biomass, which are more amenable to produce three high quality products: bio-oil, gas, and bio char. In this respect, this lesson reviews the biomass pyrolysis using microwave irradiation from several points of view, starting from fundamentals of microwave irradiation, types of microwave absorbers, and chemistry of non-catalytic MAP and focusing on chemistry of catalytic MAP plus various categories of catalysts. Recent progress in the experimental studies on both non-catalytic MAP and catalytic MAP of biomass is also demonstrated with emphasis on the bio-oil yield and quality. Additionally, reaction kinetics and future prospects in the light of current studies are also given in this lessonç. Consequently, thislesson illustrates both the highlights of significant achievements from biomass pyrolysis using microwave irradiation and the milestones that are necessary to be obtained in the future.				

SKM 842	**Microwave Soil Remediation**	3	0	3	8
Purpose and Content	The lesson aims to microwave soil remediation applications . Microwave (MW) heating has been identified as a potential tool for contaminated soil and groundwater remediation due to several advantages such as simplicity, safety, flexibility, short treatment times and low risk. Within the scope of this course, the theoretical background and related techno-economic features of MW heating will be taught. Theoretical background on soil remediation by microwave heating, influencing factors, comparison with other remediation methods.				

SKM843	**Advanced Biological Nutrient Removal**	3	0	3	8
Purpose and Content	By the end of this course, participants will understand the appropriate microbiological processes for nitrogen and phosphorus removal, biological nutrient removal (BNG) in activated sludge treatment, oxidation ponds, and the design and operating criteria of integrated fixed film/activated sludge systems. This course explains the sources of nutrients in drinking water and discusses new technologies for biological nutrient removal.				

SKM816	**Obtaining Valuable Products from Wastes**	3	0	3	8

Purpose and Content	The main objective of this course is to give general information about obtaining valuable products from wastes. Course Content:What is waste, types of waste, harms of waste, waste disposal methods, waste biomass, conversion of waste biomass