Course Name						
METALLIC NANOPARTICLES: PRODUCTION AND CHARACTERIZATION						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 462E	8	2	3	2	-	-

Department/Program	Metallurgical and Materials Engineering Department		
Course Type	Elective	**Course Language**	English
Course Prerequisites	None		

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
		60	40	

Course Description	Introduction to Nanotechnology – 1 and 2, Description of the Nanoparticles, Inorganic Nanoparticles, Production Methods: Inert Gas Condensation Method, Ultrasonic Spay Pyrolysis and Hydrogen Reduction Method, Sol-Gel Method, Laser Method, The Technic of Arc Plasma, Chemical Vapour Condensation Method, Microwave Plasma Method, Precipitation from Solution, Mechanical Alloying, Characterization of Physical and Chemical Properties, Characterization of Optic and Photonic Properties, Characterization of Electronic and Magnetic Properties, Production and Characterization of Nanocomposites-polymers, Production and Characterization of Carbon Nanotubes, Industrial Applications.
Course Objectives	1. Implementation of the importance of nanoparticles for nanotechnological applications and nanostructured materials. 2. Teaching of different nanoparticle production methods 3. Teaching of physical, chemical, magnetic and optical characteristics of materials at nanoscale 4. Teaching of different characterization techniques and approaches applied to nanoparticles and nanostructured materials. 5. Providing new skills to the students for the implementation of contemporary technological applications and solution to related problem.
Course Learning Outcomes	Upon completion of this course, a student should be able to: 1. Understand the needs for nanotechnology and nanomaterials 2. Link between basic materials science knowledge and nanostructured materials by understanding phenomena at the nanometer scale are likely to be a completely new world properties of. matter at the nanoscale may not be predictable from those observed at larger scales. 3. Discuss the fundamental structure of nanoparticles and the techniques employed to characterize them. 4. Identify the metallurgical processes that are adapted for production and synthesis of nanomaterials. 5. Demonstrate appropriate levels of self-motivation and capabilities to describe an engineering problem and offer a solution by construction and utilization of functional structures designed from atomic/molecular scale and with at least one characteristic dimension measured in nanometers.
Textbook	**Di Ventra, M., Evoy, S., Heflin, R. J, 2004**, Introduction to nanoscale science and technology: Kluwer Academic Publishers, Boston.
Other References	**Rao, R.N.C, Müller, A., Cheetham, K.A., 2004,** The Chemistry of Nanomaterials Vol. I and Vol. II (Synthesis, Properties and Applications), Wiley – VCH Verlag GmbH&Co. KgaA, Weinheim. **Schmid, G., 2004,** Nanoparticles,From Theory to Application, Wiley – VCH Verlag GmbH&Co. KgaA, Weinheim. **Poole, P. J., Owens, J. F., 2003**, Introduction to nanotechnology, J. Wiley HobokenNJ. **Korvink, J.G., Greiner, A., 2002,** Semiconductors for Micro and Nanotechnology, An Inroduction for Engineers, WILEY-VCH. **Wang S.X., Taratorin, A.M., 1999,** Magnetic Information Storage Technology, Academic Press.
Homework & Projects	
Laboratory Work	
Computer Use	
Other Activities	

Assessment Criteria		**Quantity**	**Effects on Grading, %**
	Activities	**-**	**-**
	Midterm Exams	**MIN 1**	**35**
	Quizzes	**-**	**-**
	Homework	**-**	**-**
	Projects	**-**	**-**
	Term Paper/Project	**MIN 1**	**15**
	Laboratory Work	**-**	**-**
	Other Activities	**-**	**-**
	Final Exam	**1**	**50**

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction to Nanotechnology - 1	1
2	Introduction to Nanotechnology – 2	1
3	Description of the Nanoparticles	1
4	Inorganic Nanoparticles: (Metals, Semiconductrs, Dielectrics), Oxides and Ceramic Based Naonoparticles	2
5	Production Methods - 1: Inert Gas Condensation Method, Ultrasonic Spay Pyrolysis and Hydrogen Reduction Method	2
6	Production Methods - 2: Sol-Gel Method, Laser Method, The Technic of Arc Plasma	2
7	Production Methods - 3: Chemical Vapour Condensation Method, Microwave Plasma Method,	2
8	Production Methods - 4: Precipitation from Solution, Mechanical Alloying	2
9	Characterization of Physical and Chemical Properties	3,4
10	Characterization of Optic and Photonic Properties	3,4
11	Characterization of Electronic and Magnetic Properties	3,4
12	Production and Characterization of Nanocomposites-polymers	3,4
13	Production and Characterization of Carbon Nanotubes	3,4
14	Industrial Applications	5

Relationship between the Course and Metallurgical and Materials Engineering Curriculum

	Program Outcomes	Level of Contribution		
		1	**2**	**3**
1	Ability to apply the knowledge of mathematics, science and engineering principles to solve problems in metallurgical and materials engineering (ABET:a)			X
2	Ability to characterize materials using standard and/or self designed experimental methods and to evaluate the results (ABET:b)		X	
3	Ability to design a system or a process, taking into consideration of the desired specifications, quality, ethics and environment. (ABET:c)			
4	Ability to communicate both orally and in the written form and to take part in, and provide leadership of the teams in the elucidation of engineering problems; (ABET:d, g)			
5	Ability to define, formulate and solve engineering problems in the development, production, processing, protection and usage of engineering materials. (ABET:e)			X
6	An understanding of professional and ethical responsibilities(ABET:f)			
7	An understanding of current/contemporary issues and impact of engineering solutions in broad cultural, national and global levels;. (ABET:h, j)		X	
8	A comprehension of the nature of engineering progress closely linked with the development of new materials and production processes. An ability to engage in life-long learning and a recognition of its necessity (ABET:i)		X	
9	Ability to use essential tools and techniques of modern engineering in the development, production, processing, protecting of the existing and new engineering materials. (ABET:k)			X

1: Little, 2. Partial, 3. Full

Course relationships with major elements of the field and material classes

		Level of Contribution		
		1	**2**	**3**
MAJOR ELEMENT OF THE FIELDS	STRUCTURE			**X**
	PROPERTIES			**X**
	DESIGN EXPERIMENT/ANALYSE DATA	**X**		
	PROCESSING			**X**
	COST/PERFORMANCE	**X**		
	QUALITY/ENVIRONMENT		**X**	
	DESIGN PROCESS OR PRODUCT		**X**	
MATERIAL CLASSES	METAL			**X**
	CERAMICS		**X**	
	POLYMERS		**X**	
	COMPOSITES		**X**	

1: Little, 2. Partial, 3. Full

Prepared by	**Date**	**Signature**
Prof. Dr. Sebahattin GÜRMEN Prof. Dr. Burak ÖZKAL	December 2020	