Course Name						
METALLIC NANOPARTICLES: PRODUCTION AND CHARACTERIZATION						
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Course Implementation, Hours/Week**		
				Theoretical	**Tutorial**	**Laboratory**
MET 462E	8	2	4	2	-	-

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

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
	-	60	20	-

Course Description	Introduction to Nanotechnology – 1 and 2, Description of the Nanoparticles/Nanopowders, 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 (Textile, Energy)
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	1.Vollath, D., 2013, Nanoparticles - nanocomposites - nanomaterials an introduction for beginners, Wiley-VCH Verlag GmbH & Co., Weinheim,Germany.ISBN : 978-3-527-33460-5. 2.Lee, S., Henthorn, K. H., 2012, Particle technology and applications, Taylor & Francis Group, LLC., CRC Press, Boca Raton, FL, USA. ISBN : 978-1-43988167-5. 3.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. 4.Schmid, G., 2004, Nanoparticles,From Theory to Application, Wiley – VCH Verlag GmbH&Co. KgaA, Weinheim. 5.Poole, P. J., Owens, J. F., 2003, Introduction to nanotechnology, J. Wiley HobokenNJ.
Homework & Projects	Homework are given for better understanding the lecture after the topic is explained
Laboratory Work	-
Computer Use	-
Other Activities	-

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	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 and Properties	1
4	Nanoparticles (Metal, Alloy, Composite, Oxides and Ceramic Based Nanoparticles), Production Approaches: Bottom-Up and Top Down	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

	Student Outcomes	Level of Contribution		
		1	**2**	**3**
1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering science and mathematics		**X**	
2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare as well as global, cultural, social, environmental and economic factors		**X**	
3	an ability to communicate effectively with a range of audiences			
4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts	**X**		
5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	**X**		
6	an ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgement to draw conclusions	**X**		
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies		**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 AND GLASS		**X**	
	POLYMER		**X**	
	COMPOSITES		**X**	
	BIOMATERIALS			

1: Little, 2: Partial, 3: Full

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