Course Name						
Materials Science II						
				Course Implementation, Hours/Week		
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Theoretical**	**Tutorial**	**Laboratory**
MET 232	4	3	5	3	-	-

Department/Program	Metallurgical and Materials Engineering		
Course Type	Required	**Course Language**	Turkish
Course Prerequisites	None		

Course Category by Content, %	**Basic Sciences**	**Engineering Science**	**Engineering Design**	**General Education**
		80	20	

Course Description	Atomic structures and types of bonding in materials, the “Electronic Band” theory, coloring of metals and semiconductors, optical properties of materials, atomic and molecular origin of colors, electrical conductivity and resistivity of materials, the factors affecting the conductivity of materials, metals, semiconductors and isolators, extrinsic and intrinsic semiconductors, single crystal materials, electronic device fabrication concept, dielectric and ferro-electric materials, heat capacity, thermal expansion and thermal conductivity of materials, effects of electron configurations on the magnetic behavior of materials, classification of magnetization and magnetic materials.
Course Objectives	1. To make the importance and role of the materials science in the engineering applications understood. 2. To teach the properties, structure and production processes of materials and to make the students understand the strong relations between them. 3. To give an understanding on the material selection and design using material science knowledge.
Course Learning Outcomes	1. After completing this course the student will be able to understand: 2. The relation between chemical composition-atomic bonding and the properties of materials. 3. The electron band theory and define whether the material is conductor, semiconductor or isolator depending on its electron band structure. 4. Piezoelectric effect and the crystal structure of the piezzo electric materials. The students also will be able to use the equation for piezzo electric effect in the problem solution. 5. Magnetization in the materials and the relation between the magnetic properties and the electron configuration of the materials. 6. Heat capacity, thermal conduction and thermal expansion and use them in the related problem solutions. 7. The optical properties of materials.
Textbook	• Hummel, R.E., “Electronic Properties of Materials”, 3rd Ed., Springer, 2005, ISBN No: 0-387-95144-X. • White, M.A., “Properties of Materials”, Oxford University Press, USA,1999, ISBN No: 978-0195113310. • Askeland, D.R., Phule, P.P., “The Science and Engineering of Materials”, Thomson Learning, 2005, ISBN 978-0534553968. • Schaffer, P., Saxena, A., Sanders, T.H., Antolovich, S.D., Warner, S.B., “Science and Design of Engineering Materials”, J, McGraw-Hill, 2000, ISBN 9780072448092.
Other References	• Kasap, S.O., “Principles of Electrical Engineering Materials and Devices”, Revised Edition, McGraw – Hill, 2000, ISBN No: 0-07-116471-5. • Mitchell, B.S., “An Introduction to Materials Engineering and Science for Chemical and Materials Engineers”, John Wiley&Sons, 2004. • Neamen, D.A., “Semiconductor Physics and Devices: Basic Principles”, 3rd ed., McGraw-Hill, 2003, ISBN No: 0-07-119862-8
Homework & Projects	
Laboratory Work	none
Computer Use	
Other Activities	

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterm Exams	MIN 1	40
	Quizzes	-	-
	Homework	-	-
	Projects	-	-
	Term Paper/Project	-	-
	Laboratory Work	-	-
	Other Activities	-	-
	Final Exam	1	60

COURSE PLAN

Weeks	Topics	Course Outcomes
1	Introduction to crystal structures, atomic bonding and electrical conduction concept	1,2
2	The types of bonding and introduction to “Electron Band Theory”	1,2
3	Conduction, semi-conduction and isolation behavior of materials depending on the electron band structure.	1,2
4	Semiconductor materials and doping of the semiconductors. Electronic materials and micro device concept: p-n junction diode, metal-semiconductor junction (Schottky) diode and n-p-n / p-n-p transistors.	2
5	Single crystal materials and semiconductor micro device production techniques	2
6	Dielectric materials and polarization mechanisms	1,2
7	Piezoelectric crystals and piezzo electric effect: theory and calculations.	1,3
8	Magnetization mechanism and interrelation between magnetization and the electron configuration.	1,4
9	Transition metals and magnetic materials	4
10	Thermodynamics, kinetics and thermal properties of materials, MIDTERM	5
11	Thermal properties of materials: heat capacity, thermal expansion and thermal conduction calculations	5
12	Interactions between materials and electron, photon, X-rays: optical emission, luminescence, fluorescence, phosphorescence, Raman shift and x-ray fluorescence processes.	1,2,6
13	Optical properties of materials	2,6
14	Optical properties of materials	2,6

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 and surface treatment 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			
	PROCESSING		x	
	COST/PERFORMANCE	x		
	QUALITY/ENVIRONMENT	x		
	DESIGN PROCESS OR PRODUCT		x	
MATERIAL CLASSES	METAL			x
	CERAMICS			x
	POLYMERS	x		
	COMPOSITES			

1: Little, 2. Partial, 3. Full

Prepared by	Date	**Signature**
Doç. Dr. Kürşat KAZMANLI	30.12.2009	

<table>
<tr><td colspan="7">Course Name</td></tr>
<tr><td colspan="7">Transport Phenomena</td></tr>
<tr><td rowspan="2">Code</td><td rowspan="2">Semester</td><td rowspan="2">Local Credits</td><td rowspan="2">ECTS Credits</td><td colspan="3">Course Implementation, Hours/Week</td></tr>
<tr><td>Theoretical</td><td>Tutorial</td><td>Laboratory</td></tr>
<tr><td>MET 242E</td><td>4</td><td>3</td><td>5</td><td>2</td><td>2</td><td>-</td></tr>
</table>

<table>
<tr><td>Department/Program</td><td colspan="4">Metallurgical and Materials Engineering</td></tr>
<tr><td>Course Type</td><td>Required</td><td>Course Language</td><td colspan="2">English</td></tr>
<tr><td>Course Prerequisites</td><td colspan="4">(None)</td></tr>
<tr><td rowspan="2">Course Category by Content, %</td><td>Basic Sciences</td><td>Engineering Science</td><td>Engineering Design</td><td>General Education</td></tr>
<tr><td></td><td>80</td><td>20</td><td></td></tr>
<tr><td>Course Description</td><td colspan="4">Introduction, Dimensions and Units of Measurement, The concept of viscosity, Steady-state unidirectional flow, The differential equations of flow, Applications of differential equations of flow, Turbulent flow, Overall material and energy balance in fluid flow, Applications of the overall energy balance, Thermal conductivity and steady state conduction, Unsteady state conduction of heat, Heat transfer by convection, Heat transfer by radiation, Mass diffusivity: steady state diffusion, Unsteady state diffusion, Mass transfer by convection, Mass transfer models and correlations, Chemical rate phenomena, Applications of rate phenomena theory, Flow behavior in chemical reactors.</td></tr>
<tr><td>Course Objectives</td><td colspan="4">Transport Phenomena is an engineering course designed to introduce students to the theory and applications of fluid mechanics, also known as momentum transport. The principal means of analyzing and understanding fluid motion comes from mass, momentum and energy balances applied to fluids. The first part of the course will focus on macroscopic or integral balances, predominantly those of mass, momentum, and mechanical energy, applied to finite control volumes of fluids. This part provides the most practical content of the course, as the students will learn general design principles of flow in pipes and pipe networks. The second part of the course will focus on microscopic or differential balances, predominantly those of mass and momentum, applied to differential (infinitesimal) volumes of fluids. This part leads to fundamental differential equations, the Equation of Continuity and the Navier-Stokes equations, which govern all (actually, nearly all) fluid motion, and whose application can provide substantial information on fluid velocity patterns, pressure distributions and other stresses arising from or associated with the flow.</td></tr>
<tr><td>Course Learning Outcomes</td><td colspan="4">1. Ability to apply knowledge of mathematics (calculus and differential equations) and physics (laws of conservations of mass, momentum and energy) to transport phenomena related to materials,
2. Ability to analyze transport phenomena related to materials, by formulating the problems mathematically (into differential equations with proper boundary conditions) and solving them analytically or with the help of equation-solving tools,
3. Ability to design materials processing (e.g., casting, welding, heat treating, crystal growth and semiconductor processing) based on transport phenomena
4. Knowledge of contemporary issues in transport phenomena in materials processing, e.g., computer simulation of materials production and processing.</td></tr>
<tr><td>Textbook</td><td colspan="4">Themelis N.J., Transport and Chemical Rate Phenomena, Gordon & Breach, 1995</td></tr>
<tr><td>Other References</td><td colspan="4">1. Bird R.B., Stewart W.E. and Lightfoot E.N., Transport Phenomena, Wiley, 1960.
2. Szekely J. and Themelis N.J., Rate Phenomena in Process Metallurgy, Wiley-Interscience, 1971.
3. Geiger G.H. and Poirier D.R., Transport Phenomena in Metallurgy, Addison-Wesley, 1973.
4. Geankoplis C.J., Transport Processes: Momentum, Heat, and Mass, Allyn & Bacon, Inc., 1983.</td></tr>
<tr><td>Homework & Projects</td><td colspan="4">All homework problems are to be handed-in a week after they are assigned. Homework problems may be used as a source for exams.</td></tr>
<tr><td>Laboratory Work</td><td colspan="4">None</td></tr>
<tr><td>Computer Use</td><td colspan="4">Being able to work with computer programs MS Word and MS Excel</td></tr>
<tr><td>Other Activities</td><td colspan="4"></td></tr>
<tr><td rowspan="10">Assessment Criteria</td><td colspan="2">Activities</td><td>Quantity</td><td>Effects on Grading, %</td></tr>
<tr><td colspan="2">Midterm Exams</td><td>1</td><td>25 %</td></tr>
<tr><td colspan="2">Quizzes</td><td>3</td><td>15 %</td></tr>
<tr><td colspan="2">Homework</td><td>3</td><td>15 %</td></tr>
<tr><td colspan="2">Projects</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Term Paper/Project</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Laboratory Work</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Other Activities</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Final Exam</td><td>1</td><td>45 %</td></tr>
<tr><td colspan="4">All exams and quizzes will be conducted as open-book.</td></tr>
</table>