

## Engineering Program

**Specialization**      Production and Computer Aided Manufacturing Technology

**Course Number**     0202122

**Course Title**        **Engineering Materials Laboratory**

**Credit Hours**        (1)

**Theoretical Hours**   (0)

**Practical Hours**     (3)

**Brief Course Description:**

Preparation of specimen: Macrostructure observation, Microscopic observation, Cooling curves and phase diagrams, grain size, material phases and metallic structure features, materials structure analysis

**Course Objectives:**

At the end of this course student will be able to:

1. Use the metallurgical microscope to study microstructure
2. Practically distinguish between metallurgical structure and the different phases and micro/macro structural features

**Detailed Course Description:**

Number	Title	Content	Time
	Optical observation of cast macrostructure	Cast preparation (melting/casting/grinding and polishing) Optical observation	
	Effect of mold material/cast temperature on microstructure	Casts preparation (melting/casting/grinding and polishing) Optical observation Drawing and comparing	
	Preparation and observation of ferrous and non-ferrous metallurgical specimens	Selection Cutting Grinding Polishing Etching Mounting (cold/hot)	
	Metallurgical microscope concept	Parts Concept	
	Microscopic specimen observation	Metallurgical microscope to observe metallurgical microstructure and to distinguish different phases and metallic structure features	
	Non-Crystalline material cooling curve	Melting Cooling curves construction (manual/computer aided)	
	Crystalline material cooling curve	Melting Cooling curves construction (manual/computer aided)	
	Binary alloy equilibrium phase diagram (completely soluble in the liquid state, completely/partially soluble or insoluble in the solid state)	Melting Cooling curves construction (manual/computer aided) Binary phase diagram construction	
	Cast iron types macro/micro-sopic observation	Grey cast iron White cast iron Chilled cast iron	

		Spherodite Malleable cast iron	
	Electrical properties		
	Magnetic properties		
	Thermal properties (conductivity...)		
	Mechanical properties (stress-strain diagram)		
	Hardness test		
	Thermal expansion		

#### Evaluation Strategies:

Evaluation		Percentage	Date
Exams	Midterm	20%	
	Final Exam	50%	
Projects and Laboratory Assignments		30%	

#### Teaching Methodology:

- Lecturing
- Workshop practicing and team work
- Technical videos watching

#### Text Books & References:

##### Text Books:

- An Introduction to Material science and Engineering, William D. Callister (last edition)
- علم المواد الهندسية، م. محمود عمري

##### References:

- Supplied laboratory manual
- الميتالورجيا الفيزيائية (الفلزات)، أحمد سالم الصباغ
- Introduction to physical metallurgy, Avner
- علم المعادن والمعاملة الحرارية للمعادن، يولاختين
- الميتالورجيا العامة، سيفيريوكوف