

## MODULE DESCRIPTION FORM

Module Information			
<b>Module Title</b>	<b>Metallurgical Engineering</b>	<b>Module Delivery</b>	
<b>Module Type</b>	<b>Core</b>	<input type="checkbox"/> Theory <input checked="" type="checkbox"/> Lecture <input checked="" type="checkbox"/> Lab <input type="checkbox"/> Tutorial <input type="checkbox"/> Practical <input checked="" type="checkbox"/> Seminar	
<b>Module Code</b>	<b>MAE205</b>		
<b>ECTS Credits</b>	<b>8</b>		
<b>SWL (hr/sem)</b>	<b>200</b>		
<b>Module Level</b>	2		
<b>Administering Department</b>	Materials Engineering	<b>College</b>	College of Engineering
<b>Module Leader</b>	Prof. Dr. Adel K. Mahmoud	<b>e-mail</b>	adel_mahmoud_eng@uodiyala.edu.iq
<b>Module Leader's Acad. Title</b>	Professor	<b>Module Leader's Qualification</b>	Ph.D.
<b>Module Tutor</b>		<b>e-mail</b>	
<b>Peer Reviewer Name</b>		<b>e-mail</b>	
<b>Scientific Committee Approval Date</b>	01/09/2023	<b>Version Number</b>	1.0

Relation with other Modules			
<b>Prerequisite module</b>	None	<b>Semester</b>	1
<b>Co-requisites module</b>	MAE205	<b>Semester</b>	1

## Module Aims, Learning Outcomes and Indicative Contents

<b>Module Objectives</b>	<p>This module aims to</p> <ol style="list-style-type: none"> <li>1. Provide students with a fundamental understanding of metallic materials science and engineering including knowledge about metallic material properties and how they affect their selection in real world applications. Analysis of the metallic material's properties will be used in the design of engineering systems.</li> <li>2. Develop an understanding of the structure of metallic materials and attain practical experience in carrying out laboratory tests on common engineering materials.</li> <li>3. Develop an understanding of the principal properties of metallic materials and the factors which affect their performance in use.</li> </ol>
<b>Module Learning Outcomes</b>	<ol style="list-style-type: none"> <li>1. Explain importance of metallic materials science and engineering field.</li> <li>2. Relate between metallic materials (Ferrous and Non Ferrous Metals).</li> <li>3. Classify metallic materials according to their types.</li> <li>4. Describe basic definition and conception of Ferrous and Non Ferrous Metals and physical, chemical, and mechanical properties of them.</li> <li>5. Follow new developments in metallic materials application field.</li> <li>6. Give informations about metallic materials bonds, crystal structure, and crystal geometry and crystal defects.</li> <li>7. Define structure of Ferrous and Non Ferrous Metals.</li> <li>8. Offer information about Ferrous and Non Ferrous Metals.</li> <li>9. Explain the phase diagram of Iron Carbon system.</li> <li>10. Define the phases of Iron Carbon system.</li> <li>11. Calculate the amount of phases in Iron Carbon system.</li> <li>12. Explain Invariant Reactions in Fe-Fe<sub>3</sub>C.</li> <li>13. Explain Carbon steel phase diagram</li> <li>14. Slow cooling of plain carbon steel.</li> <li>15. Classify Steel and Iron alloys.</li> <li>16. Classify plain carbon steel alloys.</li> <li>17. Types of alloys steel and its application.</li> <li>18. Low alloy steel.</li> <li>19. High alloy steel.</li> <li>20. Classification of plain carbon steel and uses.</li> <li>21. Microstructure of carbon steel.</li> <li>22. Mechanical properties of carbon.</li> <li>23. Classification of cast iron.</li> <li>24. Gray iron.</li> <li>25. White iron.</li> <li>26. Malleable Iron</li> <li>27. Spheroidal Iron.</li> <li>28. Alloy Cast - Iron.</li> </ol>

	<p>29. Heat treatment of steel: Annealing, Normalizing, Hardening and Tempering.</p> <p>30. Nonferrous metals: Copper and its alloys, Aluminum and its alloys, Lead and Its alloys, Tin and Its alloys, Titanium and Its alloys.</p>
<b>Indicative Contents</b>	Basic concepts: elementary classification of metallic materials and their crystal structure. Phase diagrams for Ferrous and Non Ferrous Metals, so classify Steel and Iron alloys, study the microstructure and strengthen their alloys and give industrial applications in different sectors.

### Learning and Teaching Strategies

<b>Strategies</b>	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive seminars and by considering types of simple experiments involving some sampling activities that are interesting to the students.
-------------------	--

### Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

<b>Structured SWL (h/sem)</b> الحمل الدراسي المنتظم للطالب خلال الفصل	75	<b>Structured SWL (h/w)</b> الحمل الدراسي المنتظم للطالب أسبوعيا	5
<b>Unstructured SWL (h/sem)</b> الحمل الدراسي غير المنتظم للطالب خلال الفصل	125	<b>Unstructured SWL (h/w)</b> الحمل الدراسي غير المنتظم للطالب أسبوعيا	8
<b>Total SWL (h/sem)</b> الحمل الدراسي الكلي للطالب خلال الفصل	<b>200</b>		

### Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
<b>Formative assessment</b>	<b>Quizzes</b>	6	5% (5)	5 to 11	LO #1, #2 and #10, #11
	<b>Projects / Lab.</b>	2	10% (10)	Continuous	All
	<b>Group</b>	1	5% (5)	13	LO #5, #8 and #10

	<b>Presentation</b>				
	<b>Attendance</b>	2	10% (10)	Continuous	
<b>Summative assessment</b>	<b>Midterm Exam</b>	2hr	20% (20)	7	LO #1 - #7
	<b>Final Exam</b>	3hr	50% (50)	16	All
<b>Total assessment</b>			100% (100 Marks)		

<b>Delivery Plan (Weekly Syllabus)</b>	
	<b>Material Covered</b>
<b>Week 1</b>	1. Iron-carbon phase diagram 1.1. Solid phases in Fe-Fe <sub>3</sub> C 1.2. Invariant Reaction in Fe-Fe <sub>3</sub> C
<b>Week 2</b>	2. Carbon steel phase diagram 2.1. Slow cooling of plain carbon steel
<b>Week 3,4,5</b>	3. Ferrous alloys: 3.1 Steel and Iron alloys 3.2 plain carbon steel alloys 3.3. Types of alloys steel and its application 3.4. Low alloy steel  3.5. High alloy steel
<b>Week 6</b>	1st Exam.
<b>Week 7</b>	4. Classification of plain carbon steel and uses 4.1. Microstructure of carbon steel 4.2 . Mechanical properties of carbon steel
<b>Week 8</b>	5. Classification of cast iron 5.1 Gray iron 5.2 White iron 5.5 Alloy Cast - Iron
<b>Week 9</b>	6.1 Malleable Iron 6.2. Spheroidal Iron
<b>Week 10</b>	7. Effect of some element (manganese, Silicon, phosphourst) add to cast iron
<b>Week 11</b>	8. The production of malleable cast iron and its application
<b>Week 12</b>	9. The production of spheroidal cast iron its application

<b>Week 13</b>	2nd Exam.
<b>Week 14</b>	<b>10. Heat treatment of steel:</b> 10.1 Annealing 10.2 Normalizing 10.3 Hardening 10.4 Tempering
<b>Week 15</b>	<b>11. Nonferrous metals:</b> 11.1 Copper and its alloys 11.2 Aluminum and its alloys 11.3 Lead and Its alloys 11.4 Tin and Its alloys 11.5 Titanium and Its alloys

<b>Delivery Plan (Weekly Lab. Syllabus)</b>	
	<b>Material Covered</b>
<b>Week 1,2</b>	Lab 1: Preparation of samples
<b>Week 2,3</b>	Lab 2: Microscopic test of metallic materials
<b>Week 3,4</b>	Lab 3: Selection of metallic materials by CES EduPack
<b>Week 5</b>	Lab 4: Al-alloys phase diagram
<b>Week 6</b>	Lab 5: Copper alloys phase diagrams
<b>Week 7</b>	Lab 6: Lead alloys phase diagrams

<b>Learning and Teaching Resources</b>		
	<b>Text</b>	<b>Available in the Library?</b>
<b>Required Texts</b>	<p>1- Materials Science and Engineering: An Introduction. W. D. Callister, D. G. Rethwisch. 9th Ed., John Wiley and Sons, New York (ISBN 978-0-470-41997-7).</p> <p>2- D.R. Askeland, P.P. Phule, W.J. Wright, The Science and Engineering of Materials, 6th ed., Cengage Learning, 2010.</p> <p>3- C. Kittel, Introduction to Solid State Physics, 8th ed., Wiley, 2005.</p> <p>4- V. Raghavan, "Materials Science and Engineering: A Fir Foundations of Materials and Engineering, William F. Smith and Javad Hashemi</p> <p>5- Materials and Processes in Manufacturing by E.P</p>	Yes

	Degarmo 6- Process and Materials of Manufacturing by Lindberg 1st Course".	
<b>Recommended Texts</b>	Prentice Hall, 2006	No

<b>Grading Scheme</b>				
<b>Group</b>	<b>Grade</b>	<b>التقدير</b>	<b>Marks %</b>	<b>Definition</b>
<b>Success Group (50 - 100)</b>	<b>A - Excellent</b>	امتياز	90 - 100	Outstanding Performance
	<b>B - Very Good</b>	جيد جدا	80 - 89	Above average with some errors
	<b>C - Good</b>	جيد	70 - 79	Sound work with notable errors
	<b>D - Satisfactory</b>	متوسط	60 - 69	Fair but with major shortcomings
	<b>E - Sufficient</b>	مقبول	50 - 59	Work meets minimum criteria
<b>Fail Group (0 - 49)</b>	<b>FX – Fail</b>	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	<b>F – Fail</b>	راسب	(0-44)	Considerable amount of work required

**Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.