	Ministry of Higher Education and Scientific Research - Iraq University of Warith Al-Anbiyaa College of Engineering Aircraft Engineering Department	

MODULE DESCRIPTOR FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Materials Properties			**Module Delivery**	
Module Type	SUPLEMENT			**Theory**	
Module Code	AIE235				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level	2		**Semester of Delivery**	3	
Administering Department	Aircraft Engineering		**College**	Engineering	
Module Leader	Hayder Adnan Abdulhussein		**e-mail**	Eng.hayder.a@gmail.com	
Module Leader's Acad. Title	Asist Lecturer		**Module Leader's Qualification**	MSc	
Module Tutor	None		**e-mail**		
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**		

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	
Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية			
Module Aims أهداف المادة الدراسية	1. The foundation for understanding classification of engineering material and crystal structure. 2. Topics are designed to explore the mechanical properties of metals and their alloys, composites and advanced material. 3. The means destructive and nondestructive testing, as well as knowing the main testing of material such as tensile and hardness test. 4. The foundation for understanding the heat treatment for steel 5. Concepts of use of ferrous and none ferrous materials for various applications are highlighted.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Describe the mechanical properties of metals, and their alloys and various crystal structures. 2. Understand the microstructures of ferrous and non-ferrous alloy. 3. Apply phase diagrams to read them and from the diagram predict the microstructure after different heat treatments. 4. Explain the processes of heat treatment of various alloys. 5. Explain the different types of non-destructive tests for metal and alloy. 6. Know about composite materials and Nano and smart material as well as applications.		
Indicative Contents المحتويات الإرشادية	1. Describe how different kinds of materials (metals including alloys, ceramics and polymers) are structured in terms of atomic bonding and crystal structure and also describe how the structure will affect some of their properties; Recognize		

	product-related problem that requires taking into account the material's microstructure [9 hrs]. 2. Describe how mechanical properties of the materials are influenced by a change of the microstructure; to relate this change to the specific hardening mechanism [9 hrs]. 3. Understand the test mechanisms of different types of hardness test methods and how to select the suitable kind for each material [9 hrs] 4. Apply phase diagrams to read them and from the diagram predict the microstructure after different heat treatments [9 hrs]. 5. Choose suitable heat treatment methods for specific properties and microstructure; discuss the choices of criteria to reach a good result [6hrs].

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	The development of the student's ability to apply the knowledge in order to be able to correct analysis of the question and thus put the appropriate assumptions and interpretation to reach a solution. Through textbooks and lectures, in addition to the seminars.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	42	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	3,5,9,11	All
	Assignments	2	10% (10)		All
	Projects / Lab.	-	-	-	-
	Report	1	10% (10)	8	All
Summative assessment	Midterm Exam	2 hrs.	10% (10)	7	All
	Final Exam	3 hrs.	50% (50)	16	All
Total assessment			100% (100)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	**Classification of engineering material** Crystal Structure Unit cell , space lattice Crystal systems Body Centered Cubic Face Centered Cubic, Hexagonal Closed Pack structures.
Week 2	**Mechanical and physical properties** Tensile and compression test Engineering Stress-strain diagram Actual stress strain diagram Toughness Ductility.
Week 3	**Micro and macro hardness test** Types of hardness test Brinell, test Rockwell test Vickers test Knoop hardness test
Week 4	**Impact test** Izod test Charpy test The difference between izod and test Calculate the impact energy
Week 5	**Nondestructive Testing of Materials** Types of NDTs Principle, procedure, advantages, Limitations The non-destructive testing (NDT) methods:

	X-rays and Gamma-rays Radiography, Magnetic particles inspection Ultrasonic testing, Dye penetrate inspection
Week 6	**Thermal equilibrium diagrams** Solubility in the solid state Phase Solid solutions, compounds and mechanical mixtures Lever rule Applications on binary phase diagrams Components completely soluble, Completely insoluble or partially soluble in the solid state.
Week 7	**Thermal equilibrium diagram for Fe- Fe3C** Types of transformations: - Eutectic transformation Eutectoid transformation Pertectic transformation Lever rule
Week 8	**Alloy steel** Classification of steel. Effect of alloying elements on the properties of steel. Carbon Steel and alloy steel, stainless steel, tool and die steel, high temperature alloys etc. Selection of steel for power plants Application and various machine components
Week 9	**Heat treatments** The aim of heat treatment Types of heat treatments Annealing, Normalizing, Hardening,
Week 10	**Cast Iron** Classification of cast iron. Properties and uses of grey, white, malleable, and spheroidal graphite cast iron. Heat treatment of cast iron. Use of specific grades of cast iron in power plants and different engine parts
Week 11	**Nonferrous alloy –Aluminum alloy and its application** Classification Properties Application of -Aging and precipitation hardening Al-Si, Al-Mg and Al-Cu alloys in industry
Week 12	**Copper alloy and its application** Classification

	Properties Applications
Week 13	**Composite material** Classification of composites, Metal matrix composite Polymer matrix composite, Ceramic matrix composite Properties and applications of composites.
Week 14	**Ceramic and polymer Materials** Properties of ceramics, types and applications of ceramics. Properties of polymers, types and applications of polymers
Week 15	**Nano materials, Selection of Material and applications Smart materials** Introduction to Nano materials, Smart materials. How to select material in specific application and industrial application
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Exp. 1:
Week 2	Exp. 2:
Week 3	Exp. 3:
Week 4	Exp. 4:
Week 5	Exp. 5:
Week 6	Exp. 6:
Week 7	Exp. 7:

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	William D. Callister "Materials science and engineering: An Introduction", 9th Edition, Willy, 2012	Yes

Recommended Texts	Michael F. Ashby and David R. H. Jones, "Engineering materials: An Introduction their properties and applications", 2nd Edition, 1998	
Websites		

APPENDIX:

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

Note:

NB 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.