MODULE DESCRIPTION FORM

Module Information					
Module Title	**Materials Science**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**BME-214**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level		1	**Semester of Delivery**		1
Administering Department		Biomedecal	**College**	Engineering	
Module Leader	Hasan Allawi		**e-mail**	Hassan.as@uowa.edu.iq	
Module Leader's Acad. Title		Assist lecture	**Module Leader's Qualification**		Msc
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Name	**e-mail**	E-mail	
Scientific Committee Approval Date		01/06/2023	**Version Number**		1.0

Relation with other Modules			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1. Identify engineering materials, especially biological materials, that are in contact with the body of a living organism. 2. Identify the types of bonding between atoms of matter 3. Identify space lattice of metals 4. Calculations related with space lattice of metals 5. Mechanical properties of materials 6. Polymers: its types, properties and applications 7. Ceramics: its types, properties and applications 8. Composite materials.
Module Learning Outcomes	1. Training the student on the purposeful engineering mindset 2. Make the student able to distinguish between engineering materials and their uses. 3. Applying theoretical concepts through conducting practical experiments on the properties of matter. 4. Recognize and understand how to choose the right material in the right place. 5. The ability to analyze and discover the problem or error and the ability to find a solution to the error.
Indicative Contents	Indicative content includes the following. -**Introduction into materials science** Materials Science and Engineering. Why Study Materials Science? Classification of Materials Primary and secondary bonds. Atomic Structure Number of atoms Atomic Bonding in Solids Types of bonds in materials Types of atomic and molecular bonds Metal-crystal network. Atomic or Ionic Arrangements Crystal Structures of metals The Face-Centered Cubic (FCC) Crystal Structure The Body-Centered Cubic Crystal Structure (B.C.C). The Hexagonal Close-Packed Crystal Structure (HCP).

	Density Computations—metals Single Crystals Polycrystalline Materials Nanocrystalline Solids (Amorphous) (16hrs) - **Introduction into Mechanical behavior** Tensile testing Engineering Stress-Strain Curve Shear testing Hardness Fatigue test Some problems (8hrs) - **Introduction into Polymer** Fundamentals of Polymer Science and Technology Importance of polymers Polymerization Degree of Polymerization and Molecular Weight Linear, Branched, and Cross-Linked Polymers Network Polymers Copolymers Arrangements of polymer unite (mers) Crystallinity Polymer Crystals Plastics (12hrs) - **Introduction into Ceramics** Classification of ceramic materials Properties of ceramics: Structures of Crystalline Ceramics Types of ceramics A-Traditional Ceramics B-New Ceramics Glass Methods of producing ceramics: Bio ceramics Examples for Bio ceramics (12hrs) - **Introduction into Composites materials**

	Technology and Classification of Composite Materials Metal Matrix Composites Ceramic Matrix Composites Polymer Matrix Composites (8hrs)

Learning and Teaching Strategies	
Strategies	1.Giving lectures and solving mathematical problems, if any, on the board. 2. Use of modern technologies and display videos and practical means of electronic display (Data Show) to illustrate the shapes and drawings and diagrams and vocabulary lecture. 3. Focusing on students' participation in the lecture by asking questions, eliciting new ideas and finding other ways to solve mathematical problems. 4- Adopting the homework method to solve the exercises by the students and evaluating their solutions in the classroom.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2.5
Total SWL (h/sem)	100		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	10% (10)	3, 6, 10,13	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	3, 12	LO # 4, 5, 7 and 8
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction into materials science Materials Science and Engineering. Why Study Materials Science? Classification of Materials
Week 2	Primary and secondary bonds. Atomic Structure Number of atoms Atomic Bonding in Solids Types of bonds in materials Types of atomic and molecular bonds
Week 3	Metal-crystal network. Atomic or Ionic Arrangements Crystal Structures of metals The Face-Centered Cubic (FCC) Crystal Structure The Body-Centered Cubic Crystal Structure (B.C.C).
Week 4	The Hexagonal Close-Packed Crystal Structure (HCP). Density Computations—metals Single Crystals Polycrystalline Materials Nanocrystalline Solids (Amorphous)
Week 5	Introduction into Mechanical behavior

	Tensile testing Engineering Stress-Strain Curve Shear testing
Week 6	Hardness Fatigue test Some problems
Week 7	Mid-term Exam
Week 8	Introduction into Polymer Fundamentals of Polymer Science and Technology Importance of polymers Polymerization
Week 9	Degree of Polymerization and Molecular Weight Linear, Branched, and Cross-Linked Polymers Network Polymers Copolymers
Week 10	Arrangements of polymer unite (mers) Crystallinity Polymer Crystals Plastics
Week 11	Introduction into Ceramics Classification of ceramic materials Properties of ceramics:
Week 12	Structures of Crystalline Ceramics Types of ceramics A-Traditional Ceramics B-New Ceramics
Week 13	Glass Methods of producing ceramics: Bio ceramics Examples for Bio ceramics
Week 14	Introduction into Composites materials Technology and Classification of

	Composite Materials
Week 15	Metal Matrix Composites Ceramic Matrix Composites Polymer Matrix Composites
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Lab 1: Sample Preparation for Microscopic Inspection
Week 2	Lab 2: Microscopic Inspection for specimen
Week 3	Lab 3: Tensile Test
Week 4	Lab 4: Hardness Test
Week 5	Lab 5: Fatigue test
Week 6	Lab 6: Impact Test
Week 7	Lab 7: Properties of Engineering Materials with Regular Shapes -Bulk density - Specific weight: - The porosity

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	1- (Engineering metallurgy, part 1) Higgins, Raymond A.- Engineering Metallurgy - Applied Physical Metallurgy- Elsevier (1993). 2- (Engineering metallurgy, part 2) Higgins, Raymond A.- Engineering Metallurgy - Applied Physical Metallurgy- Elsevier (1993).	No
Recommended Texts	1-The Science and Engineering of Materials, Seventh Edition, Donald R. Askeland, University of	No

	Missouri—Rolla, Emeritus, Wendelin J. Wright, Bucknell Univers, 2016. 2-Materials Science and Engineering An Introduction, William D. Callister, Jr. and David G. Rethwisch, 2010	
Websites	/https://www.sanfoundry.com	

Grading Scheme
مخطط الدرجات

Group	Grade	Marks (%)	Definition
Success Group (50 - 100)	**A -** Excellent	90 - 100	Outstanding Performance
	B - Very Good	80 - 89	Above average with some errors
	C - Good	70 - 79	Sound work with notable errors
	D - Satisfactory	60 - 69	Fair but with major shortcomings
	E - Sufficient	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX –** Fail	(45-49)	More work required but credit awarded
	F – Fail	(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.