هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد
NCAAA

2024
TP-153

Course Specification
(Bachelor)

Course Title:	Material Science
Course Code:	CHM 1344
Program:	Bachelor of Science in Chemistry
Department:	Chemistry
College:	Science
Institution:	Imam Mohammed Ibn Saud Islamic University
Version:	2024 V1
Last Revision Date:	14 October 2024

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A. General information about the course:

-1. Course Identification

1. Credit hours: 2 (1, 0, 3)					
2(2 Lectures, 0 Tutorials, 0 Lab)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐ Required		☒ Elective		
3. Level/year at which this course is offered: Level 5, 6/ Third year					

4. Course general Description:
The topics covered in this course include: Types of structural and functional materials, binary phase diagrams of metals and alloys, microstructure analysis, physical and mechanical properties of materials, heat treatment processes, welding of materials, materials inspections, destructive and nondestructive testing of materials, and applications of engineering materials.
5. Pre-requirements for this course (if any):
Physical chemistry 2/ CHM 1242
6. Co-requisites for this course (if any):
None
7. Course Main Objective(s):
At the end of this course the student will be able to:

- **Describe the classifications of different types of materials.**
- **Explain the different fabrication methods of structural and functional materials.**
- **Use the binary phase diagrams to explain the possibilities of formation of different types of alloys, intermetallic compounds and composites.**
- **Understand how the microstructure effects on the materials properties and behavior.**
- **Predict fundamentals physical and mechanical properties of materials based on knowledge of their crystal structure and microstructure.**
- **To study the different heat treatment and welding methods of metallic materials.**
- **Describe the destructive and nondestructive techniques of testing materials.**

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- Explain the different applications of engineering materials.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning	0	0
3	Hybrid • Traditional classroom • E-learning	0	0
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	15
2.	**Laboratory/Studio**	45
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)**	0
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recognize the basic physical properties of materials based on knowledge of their structure.**	**K1, K2, K3**	▪ Four hours are weekly containing lectures and laboratory activities.	▪ Quizzes Assignments ▪ Discussions. ▪ Participation. Short quizzes

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Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
			▪ A Private study including home exam. ~~Lecture~~	
1.2	To describe the binary phase diagrams of metals and alloys and ~~its correlation with the~~ microstructure and properties.	K1, K2, K3	▪ Four hours are weekly containing lectures and Laboratory activities ▪ Group discussion. ~~Lecture and group discussions~~	▪ Quizzes Assignments. • Oral Discussion marks Laboratory Reports ~~Oral tests and MCQs, Homework~~
1.3	To recall the fundamentals of the change in the ~~microstructure by the~~ heat treatment processes.	K1, K3	▪ Four hours are weekly for laboratory activities ▪ Think, talk, and review microstructure and the heat treatment processes. ~~Lecture and group discussions~~	▪ Quizzes ▪ Home exam ▪ Oral Discussions. ~~Homework assignment marks, Oral test and Short quizzes.~~
2.0	Skills			
2.1	To develop different samples of materials ~~and determine the microstructure,~~ determine the microstructure, and evaluate the physical and mechanical properties of different types of materials.	S1, S2, S3	Introduce some examples of microstructure, of some materials, with physical and mechanical properties ~~Lectures and laboratory experiments~~	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Participation ▪ Oral Discussion, Laboratory Reports Home Exam. ~~Solved problem marks, Short quizzes and Laboratory reports Numerical problem~~
2.2	To analyze data and results through analytical thinking,	S1, S2, S3	• Group Discussions • Laboratory Experiments ~~Brain~~	• Questions in Lectures. • Laboratory Reports • Short Quizzes and

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Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
	with evaluation of the gained information.		~~storming and self study~~	Exams. • Oral Discussion~~Work portfolio and homework~~
2.3	To evaluate oral communication and technical writing skills, with the capability of using electronic mail, and Networks in communicating with others	S3	▪ Lectures and Oral Discussions. ▪ Brainstorming Exercises~~Motivate students to ask questions and to give response.~~	▪ Questions in Lectures.Short Quizzes and Exams.~~Participation marks~~
2.4	To interpret diagram and explain experimental data during laboratory classes, demonstrate technical writing and oral communication skills, and operate electronic mail and network in communication with classmates and teachers.	S1; S3; S4	• Encourage the students to use the Chemicals, Glassware and Instruments with caring and safety~~Oral participation~~ • Group discussions ~~and lab experiment and reports~~ • ~~Encourage students to use electronic mail to submit homework and assignments.~~	▪ Assignments ▪ Laboratory Report. • ~~Oral tests and lab performance, reports and sheets Marks~~ ~~Assignments and homework marks~~
3.0	Values, autonomy, and responsibility			
3.1	To appraise collaborative work skill.	V1, V2	• Group discussion and assignments • homework • Lab-reports • Virtual labs and demonstrations	• Oral tests and lab performance, reports and sheets Marks • Assignments and homework marks

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C. Course Content

No	List of Topics	Contact Hours
1.	Types of structural and functional materials	2
2.	Fabrication techniques of different types of materials	3
3	Binary and Iron/Carbon phase diagrams	2
4	Microstructure analysis	2
5	Heat Treatments and welding of metals and alloys	2
6	Physical and mechanical properties of materials	2
7	Nondestructive and destructive testing of materials	2
	Total	15

No	List of Experiments	Contact hours
1	Safety, Laboratory equipment's, writing a report and how to measure the dimentions of specime.	31
2	Fabrication of Al intermetallic and copper solid solutions by casting method.	34
3	Fabrication of metal and polymer matrix composites by vortex and powder Technology.	3
4	Determination of the density and porosity content of porous materials.	3
5	Electroless deposition and consolidation of nanocomposite materials.	3
6	Fabrication and annealing of ferro and ferri magneticferrimagnetic materials.	34
7	Electrodeposition of laminated composite materials.	3
8	Measuring the electrical conductivity of metallic materials.	3
9	Estimation of the thermal conductivity of metallic materials.	3
10	Heat treatments and annealing of metals and alloys.	34
11	Welding of low melting point metals and its alloys.	3
12	Metallographic and Microstructure investigations of metallic materials.	34
13	Measuring of mechanical properties (compression, fracture strength and hardness) of ceramic and metallic materials.	34
14	Revision	3
	Total	42557

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1	6th/ 7th week	10 %
2.	Midterm 2	11th/ 12th week	10 %

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
3.	Quizzes, Home Works, class participation, and mini projects	During the semester	10 %
4.	Laboratory	All the semester	30 %
5.	Final Exam	16- 17thweek	40 %
6.	Total	All weeks	100 %

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Materials Science and Engineering: An Introduction 10th Edition, by William D. Callister Jr., David G. Rethwisch, Wiley, 2020, ISBN 978-1119721772
Supportive References	1. Powder Metallurgy & Particulate Materials Processing ,Randall M German, Metal Powder Industry, 2005, ISBN 9780976205715
Electronic Materials	Blackboard
Other Learning Materials	https://bcs.wiley.com/he-bcs/Books?action=contents&itemId=1119405491&bcsId=10952

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Each of the class room should be equipped with a whiteboard and a projector, with a maximum of 20 students. • In each laboratory, a list of safety and precautions are provided. • In each lab has proper ventilation, and well equipped with instruments. • In each lab, containers for solid waste, liquid waste, and crushed glasses. • Each lab has a small pharmacy for first aid in case of an accident • In each lab, the rules, conditions, and safety mechanism as well list of Risk, Safety precautions

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Items	Resources
	according to Merck Catalogue are hanging in the labs
Technology equipment (projector, smart board, software)	The rooms are equipped with data show, Smart Board, WI-FI access.
Other equipment (depending on the nature of the specialty)	• Appropriate Glasswares for carrying the requested experiments (conical flasks, beakers, measuring cylinders) • Appropriate fine chemicals and solvents (distilled Water, metal ingots such as aluminum, steel and copper) • Analytical balance (4 digits), Set of innert gases , PC, Windows® 95 or higher, thermometer, Filter papers , clamps, stands, crucibles, avometer, electric furnace, pressing machine, dies, rectifier, polishing machine, polishing papers, optical microscope, hot plate and welding tools, mechanical stirrier, micrometers and vernier caliper.

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.
Effectiveness of Students assessment	**Program Leaders**	**Direct:** Course e-Portfolio. **Indirect:** Course report.
	Students	**Indirect:** Second examiner checklist-Course report.
Quality of learning resources	**Faculty (Academic Advisory)**	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.

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Assessment Areas/Issues	Assessor	Assessment Methods
The extent to which CLOs have been achieved	Course Responsible	Direct: Exams - Course e-Portfolio.

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	COUNCIL OF DEPARTMENT OF CHEMISTRY~~COUNCIL OF DEPARTEMENT OF CHEMISTRY~~
REFERENCE NO.	7 (NO. 2/3)
DATE	29/3/1446 - 2/10/2024

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