



Course Specifications

Course Title:	Electronic Microscope
Course Code:	2034221-3
Program:	Bachelor in Physics
Department:	Physics Department
College:	College of Science
Institution:	Taif University

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A. Course Identification

1. Credit hours: 3
2. Course type
a. University <input type="checkbox"/> College <input checked="" type="checkbox"/> Department <input type="checkbox"/> Others <input type="checkbox"/>
b. Required <input type="checkbox"/> Elective <input checked="" type="checkbox"/>
3. Level/year at which this course is offered: 12 th Level / 4 th Year
4. Pre-requisites for this course (if any): None
5. Co-requisites for this course (if any): None

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4	100%
2	Blended	0	0%
3	E-learning	0	0%
4	Distance learning	0	0%
5	Other	0	0%

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	40
2	Laboratory/Studio	0
3	Tutorial	0
4	Others (specify)	0
	Total	40

B. Course Objectives and Learning Outcomes

1. Course Description

This course presents the student with an important introduction to the principle of Electron Microscopy (EM). How are the SEM and TEM working, the components of SEM and TEM. The course present as well as the basic information of Electron Beam/Samples Interactions, EM signals and ending with the EM resolution.

2. Course Main Objective

- Introduction to Electron Microscopy
- Principle of Electron Microscope
- Samples preparation for SEM and TEM
- Components of SEM and TEM
- Electron Beam/Samples Interactions
- EM Signals (SE, BSE and X-ray)
- SEM Depth of Field
- EM Resolution

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	Knowledge and Understanding	
1.1	State the basic information and principles of Electron Microscope and recognize the difference between SEM and TEM techniques.	K1
1.2	Describe how the EM techniques obtain data and realize how the data gathering and analysis.	K5
2	Skills :	
2.1	Explain physical principles and concepts relevant to the course and their applications.	S4
2.2	Utilize critical thinking techniques to cause, listen, make observations, and draw conclusions.	S1
3	Values:	
3.1	Show responsibility in working independently with continuous improvement of personal capacities.	V1

C. Course Content

No	List of Topics	Contact Hours
1	Unit 1: Introduction to Electron Microscopy (EM) <ul style="list-style-type: none"> Principle of Electron Microscopy Scanning Electron Microscopy (SEM) Transmission Electron Microscopy (TEM) 	8
2	Unit 2: Components of Electron Microscopy <ul style="list-style-type: none"> EM column EM electromagnetic lens and apertures EM chamber Signals detectors 	8
3	Unit 3: Electron beam/samples interactions <ul style="list-style-type: none"> Secondary Electron signals Backscattered electron signals X-ray signals TEM signals 	8
4	Unit 4. Samples preparation <ul style="list-style-type: none"> Cutting and drying coating and coating materials Samples mounting Sample inserting 	8
5	Unit 5: EM images <ul style="list-style-type: none"> SEM depth of Field Accelerating voltage Spot size Objective aperture size Working distance Focus and alignment: Resolution 	8
Total		40

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	Knowledge and Understanding		
1.1	State the basic information and principles of Electron Microscope and recognize the difference between SEM and TEM techniques.	Lecture	Written exam and Homework reports
1.2	Describe how the EM techniques obtain data and realize how the data gathering and analysis.	Lecture and Group discussion	Written exam and Quizzes
...			
2.0	Skills		
2.1	Explain physical principles and concepts relevant to the course and their applications.	Lecture	Written exam and Homework reports
2.2	Utilize critical thinking techniques to cause, listen, make observations, and draw conclusions.	Group discussion	Quizzes
...			
3.0	Values		
3.1	Show responsibility for working independently and for continuous improvement of personal capacities	Group discussion	Project
3.2			
...			

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Assignments and Interaction during lectures	continuous	10
2	Midterm exam	6	30
3	short exam	9	10
4	Final exam	12	50

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

7 Hours per week during office-hours, in teacher's staffroom or as per the arrangement made by the teacher.

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	<ul style="list-style-type: none"> Electron Microscopy and Analysis (3rd edition, electron copy) Peter J. Goodhew, John Humphreys, and John Humphreys, Taylor & Francis Group (2001) Course notes
Essential References Materials	Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM, © 2005 Springer Science+Business Media, Inc.
Electronic Materials	<ul style="list-style-type: none"> https://www.nanoscience.com/techniques/scanning-electron-microscopy/ https://www.jeol.co.jp/en/science/sem.html https://en.wikipedia.org/wiki/Scanning_electron_microscope
Other Learning Materials	<ul style="list-style-type: none"> Multi media / CD associated with the text books (when available).

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture room with max 60 seats Labs
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show, Smart Board, Software
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	NON

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Student Feedback on Effectiveness of Teaching	Students	<ul style="list-style-type: none"> Indirect
Evaluation of Teaching	<ul style="list-style-type: none"> Instructor Program coordinator Departmental council Faculty council 	<ul style="list-style-type: none"> Indirect
Improvement of Teaching	<ul style="list-style-type: none"> Program leaders Relevant committee 	<ul style="list-style-type: none"> Direct
Quality of learning resources	<ul style="list-style-type: none"> Students Instructor Faculty 	<ul style="list-style-type: none"> Indirect
Extent of achievement of course learning outcomes,	<ul style="list-style-type: none"> Program leaders Instructor 	<ul style="list-style-type: none"> Direct

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Course effectiveness and planning for improvement	<ul style="list-style-type: none"> • Program leaders • Instructor 	<ul style="list-style-type: none"> • Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	October 2, 2022