هيئة تقويم التعليم
Education Evaluation Commission
المركز الوطني للتقويم والاعتماد الأكاديمي
National Center for Academic Accreditation and Evaluation

ATTACHMENT 5.

T6. COURSE SPECIFICATIONS (CS)

(PHYS 541)
X-Ray Diffraction and its Applications

by

Prof. Ahmed El-Naggar
2018

هيئة تقويم التعليم
Education Evaluation Commission

Course Specifications

Institution: King Saud University	Date:
College/Department : College of Science, Physics and Astronomy Department	

A. Course Identification and General Information

1. Course title and code: X-Ray Diffraction and its Applications (PHYS 541)
2. Credit hours: **3(2+1)**
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) Physics and other science and engineering programs
4. Name of faculty member responsible for the course Prof. Ahmed El-Naggar
5. Level/year at which this course is offered: 2nd level (post-graduate)
6. Pre-requisites for this course (if any):
7. Co-requisites for this course (if any):
8. Location if not on main campus: Main campus in Diriyah , College of Science, Department of Physics & Astronomy (Boys and Girls sections)
9. Mode of Instruction (mark all that apply):

a. traditional classroom	√	What percentage?	10%
b. blended (traditional and online)	√	What percentage?	10%
c. e-learning		What percentage?	
d. correspondence		What percentage?	
f. other		What percentage?	

Comments:

B Objectives

1. What is the main purpose for this course?
   - The student should get acquainted with the fundamentals of x-Ray Diffraction (XRD) and its applications.
   - The student should be able to apply this course in his/her future research work, as XRD is the basic tool in studying the structural properties of materials.

2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)
   - Electronic materials and computer based programs have been utilized to support the lecture course material.
   - The course material was posted on the Website that could be accessed by the students enrolled in the course.
   - Demonstration of lab experiments related to the structural properties of the materials reviewed.

C. Course Description (Note: General description in the form used in Bulletin or handbook)

Course Description:
Properties of X-Rays, Geometry of Crystals, Diffraction I: Geometry, Diffraction II: Intensities of diffracted beams, Diffraction III: real samples, Laue Photographs, Powder photographs, Diffractometer measurements, Determination of crystal structure, Structure of polycrystalline aggregates.

1. Topics to be Covered

List of Topics	No. of Weeks	Contact hours
Chapter 1: Properties of X-Rays: Electromagnetic radiation, The continuous spectrum, The characteristic spectrum, Filters, Production of X-Rays, Detection of X-Rays, Safety precautions.	1.5 week	4.5
Chapter 2: Geometry of Crystals: Lattices, Crystal systems, Lattice directions and planes, Crystal structure, Stereographic projection.	1.5 week	4.5
Chapter 3: Diffraction I: Geometry: Diffraction, Bragg law, X-ray spectroscopy, diffraction directions, Diffraction methods.	1.5 week	4.5
Chapter 4: Diffraction II: Intensities of diffracted beams: Scattering by an electron, Scattering by an atom, Scattering by a unit cell, Some useful relations, Structure factor calculations, Multiplicity factor, Lorentz factor, Absorption factor, Temperature factor, Intensities of powder pattern lines, Measurements of X-Ray intensity.	1.5 week	4.5

Chapter 5: Diffraction III: real samples: Crystalline size, Strain, Perfect crystals, Amorphous and partially crystalline samples.	1.5 week	4.5
Chapter 6: Laue Photographs: Cameras, Specimens and holders, Collimators, The shapes of Laue Spots	1.5 week	4.5
Chapter 7: Powder photographs: Debye-Scherrer method, Specimen preparation, Focusing cameras, Seemen-Bohlin camera, Back reflection focusing cameras, Pinhole photographs.	1.5 week	4.5
Chapter 8: Diffractometer measurements: Introduction, General features, X-Ray optics, Detectors, Counting losses, Counting efficiency, Energy resolution, Proportional counters, Geiger counters, Scintillation detectors, Semiconductor detectors.	1.5 week	4.5
Chapter 9: Determination of crystal structure: Introduction, Preliminary treatment of data, Indexing patterns of cubic crystals, Indexing patterns of non-cubic crystals; Hexagonal systems, Orthohombic system, Determination of the number of atoms in a unit cell, Determination of atom positions, Example of structure determination.	1.5 week	4.5
Chapter 10: **Structure of polycrystalline aggregates** Introduction, Grain Size, Crystallite size, Crystal quality, Size and strain separation, Crystal orientation.	1.5 week	4.5

2. Course components (total contact hours and credits per semester):

		Lecture	Tutorial	Laboratory/ Studio	Practical	Other:	Total
Contact Hours	Planed	30			15		45
	Actual	30			15		45
Credit	Planed	30			15		45
	Actual	30			15		45

3. Additional private study/learning hours expected for students per week. 3 hours

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

On the table below are the five NQF Learning Domains, numbered in the left column.

First, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and

flow together as an integrated learning and teaching process. (Courses are not required to include learning outcomes from each domain.)

Code #	NQF Learning Domains And Course Learning Outcomes	Course Teaching Strategies	Course Assessment Methods
1.0	**Knowledge**		
	- To understand the properties of X-Rays - To get acquainted with the geometry of crystals and diffraction. - To get an experience and knowledge with diffractometer measurements. - To use different formulas to determine the crystal structure of materials	•Introducing the basic links between theory and applications in X-ray diffraction. •Homework assignments •Lecture discussions	- In-class quizzes - Midterms and final exams
2.0	**Cognitive Skills**		
	- The daily life applications of the studied topics. - The most famous and useful instruments build on the studied topics. - How technology is built from simple to advanced present states - some interesting experiments and applications in the field of X-Ray Diffraction	- Defining duties for each chapter - Advising students to search on some of the mentioned technologies (in the course) either on the websites or in the library and make reports.	* The interaction during the lectures and discussions * The reports of different asked tasks * Part of the Exams should focus on the understanding
3.0	**Interpersonal Skills & Responsibility**		
	- Writing reports - Developing the English language - Thinking in solving problems - Searching on the internet - Collecting the materials of the course - Dealing with the lectures that the student missed. - Also the students should know how to do that independently and through discussions with the others.	-Learning how to search on the internet and use the library -Learning how to cover missed lectures -Learning how to summarize lectures or to collect materials of the course -Learning how to solve difficulties in learning: solving problems – enhance educational skills -Developing his interest in Science through :(lab work, field trips, visits to scientific and research institutes). - Encouraging the student to attend lectures regularly by giving bonus marks for attendance - Giving students tasks and duties - Learning how to write reports: some of them in English language.	-Through discussions in the lectures -Checking reports -Asking questions -Quizzes and Exams

4.0	**Communication, Information Technology, Numerical**		
	- Communication with others: the lecturer – students in the class - Information Technology through: the Internet – the computer skills - Numerical skills through: solving problems- computation – data analysis)	- Advising the students to: help each other in education. -communicating with the lecturer to discuss difficulties. - Asking students to: make search on the internet for some related interesting topics. -writing reports on the computer - Asking for solving some problems and recalculating some examples.	- Discussing reports on: problems solutions - internet searching - Making discussion on some explored points - Exams
5.0	**Psychomotor**		
	Not applicable	Not applicable	Not applicable

5. Schedule of Assessment Tasks for Students During the Semester

	Assessment task (i.e., essay, test, quizzes, group project, examination, speech, oral presentation, etc.)	Week Due	Proportion of Total Assessment
1	Weekly Homework assignments		10%
2	Attendance and Participation in the class		5%
3	First Mid-term exam	6th week	20%
4	Second Mid-term exam	10th week	25%

D. Student Academic Counseling and Support

1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)

- Office hours 2 hr/ week
- Additional sessions 1hr/ week aided by 1 lab assistant

E Learning Resources

1. List Required Textbooks

1- B.D. Cullity and S.R. Stock "Elements of X-Ray Diffraction" Pearson India; 3rd edition (2014)
2- Des McMorrow, “Elements of Modern X-ray Physics” Wiley; 2 edition (April 4, 2011)
3- Kaimin Shih ,“X-Ray Diffraction: Structure, Principles and Applications (Materials Science and Technologies)” Nova Science Pub Inc; UK ed. edition (September 24, 2013)
4- Emil Zolotoyabko,”Basic Concepts of X-Ray Diffraction” Wiley-VCH; 1 edition (April 21, 2014)
5- C. Suryanarayana,”X-Ray Diffraction: A Practical Approach” Springer; Softcover reprint of the original 1st ed. 1998 edition (June 6, 2013)
6- B. E. Warren , “X-Ray Diffraction” Dover Publications; Reprint edition (June 1, 1990)

7- A. Guinier, "X-Ray Diffraction: In Crystals, Imperfect Crystals, and Amorphous Bodies" Dover Publications (June 7, 1994)
2. List Essential References Materials (Journals, Reports, etc.) 1- Kaimin Shih ,"X-Ray Diffraction: Structure, Principles and Applications (Materials Science and Technologies)" Nova Science Pub Inc; UK ed. edition (September 24, 2013) 2- C. Suryanarayana,"X-Ray Diffraction: A Practical Approach" Springer; Softcover reprint of the original 1st ed. 1998 edition (June 6, 2013)
3. List Electronic Materials, Web Sites, Facebook, Twitter, etc. Websites on the internet that are relevant to the course topics
4. Other learning material such as computer-based programs/CD, professional standards or regulations and software. Multimedia associated with the text book and the relevant websites

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access, etc.)
1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) • Lecture room with at least 25 seats • Auditorium of a capacity of not less than 25 seats for large lecture format classes Laboratory with at least 25 places
2. Technology resources (AV, data show, Smart Board, software, etc.) • Computer room containing at least 15 systems • Scientific calculator for each student.
3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list) • Availability of demonstrative materials relevant to the course material • Safety and Lab facilities

G Course Evaluation and Improvement Processes

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching • Course evaluation by student • Students- faculty meetings
2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department • Peer consultation on teaching • Departmental council discussions • Discussions within the group of faculty teaching the course
3. Processes for Improvement of Teaching • Conducting workshops given by experts on the teaching and learning Methodologies. • Periodical departmental revisions of methods of teaching. • Monitoring of teaching activates by senior faculty members.

4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution) • Providing samples of all kinds of assessments in the departmental course portfolio of each course • Assigning group of faculty members teaching the same course to grade same questions for various students. • Faculty members from other institutions are invited to review the accuracy of the grading policy.
5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. • The course material and learning outcomes are periodically reviewed and the changes to be taken are approved in the departmental meetings and higher councils. • The head of department and faculty dean take the responsibility of implementing the proposed changes.

Name of Course Instructor: **Prof. Ahmed El-Naggar**

Signature: _____ Date Specification Completed: **1-1-2018**

Program Coordinator: _____

Signature: _____ Date Received: _____