COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
X-RAY DIFFRACTION	**CHBE 583**	**1 or 2**	**3+0+1**	**3**	**10**

Prerequisites	NONE

Language of Instruction	English
Course Level	Master's Degree (Second Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	
Goals	The aim of this course is to provide students with the ability to employ x-ray diffraction analysis in their research studies.
Content	Principles of powder X-ray diffraction; The unit cell; The powder diffractometer; Factors influencing d-spacing accuracy; Factors influencing intensity accuracy; Use of internal and external standards; Sample preparation; Automated phase analysis; Computer databases used in diffraction; Computer analysis of diffraction data; Analysis of d-I data; Crystallinity; Crystal size and strain; Structure modeling; Structure refinement; Rietveld method of pattern-fitting structure refinement.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to define the fundamentals of X-ray diffraction.	2,5	1,2	A,C
2) Ability to use X-ray diffractometer	2,5	1,2,3	A,B, C
3) Ability to communicate effectively in English	8	1,2	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION TO X-RAY DIFFRACTION ANALYSIS	Lecture Notes
2	PRINCIPLES OF POWDER X-RAY DIFFRACTION	Lecture Notes
3	POWDER DIFFRACTOMETER	Lecture Notes
4	POWDER DIFFRACTOMETER	Lecture Notes
5	POWDER DIFFRACTOMETER	Lecture Notes
6	MIDTERM EXAM I	Lecture Notes
7	AUTOMATED PHASE ANALYSIS	Lecture Notes
8	COMPUTER DATABASES USED IN DIFFRACTION	Lecture Notes
9	COMPUTER ANALYSIS OF DIFFRACTION DATA	Lecture Notes
10	COMPUTER ANALYSIS OF DIFFRACTION DATA	Lecture Notes
11	STRUCTURE MODELING	Lecture Notes
12	STRUCTURE MODELING	Lecture Notes
13	RIETVELD METHOD OF PATTERN-FITTING STRUCTURE REFINEMENT	Lecture Notes
14	MIDTERM EXAM II	Lecture Notes

RECOMMENDED SOURCES	
Textbook	COURSE NOTES
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	

Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	63
Assignment + Lab. Reports	5	37
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Acquire expanded and in-depth information via performing scientific research in the field of Chemical Engineering, evaluate, interpret and implement knowledge.					
2	Be knowledgable in the contemporary techniques and methods applied in Chemical Engineering and their respective constraints.					+
3	Be cognizant of the novel and developing applications of his/her profession, study and learn them as required.					
4	Formulate Chemical Engineering problems, develop methods to solve them and implement innovative techniques in solutions					
5	Design and conduct analytical modeling and experimental research, analyze and interpret complex problems encountered in this process.					+
6	Develop novel and/or original ideas and methods; conceive innovative solutions in systems, component and process design					
7	Complete information via processing limited or incomplete data by the use of scientific methods and implement it; integrate knowledge from different disciplines					
8	Communicate in at least one foreign language at the level of European Language Portfolio B2 orally and in writing.			+		
9	Communicate stages and results of his/her studies in a systematic and clear manner orally or in writing in intra or interdisciplinary national and international settings.					

10	Defines societal and environmental aspects of Chemical Engineering applications					
11	Observe social, scientific and ethical values during collection, interpretation, and dissemination of data and in all professional activities.					
12	Lead multidisciplinary teams, develop solution methodologies for complex problems and take responsibility					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)	14	10	140
Mid-terms	2	3	6
Assignment	2	8	16
Lab. Reports	3	8	24
Final examination	1	3	3
Total Work Load			245
Total Work Load / 25 (h)			9.8
ECTS Credit of the Course			10