



National Commission for Academic Accreditation & Assessment

COURSE SPECIFICATION

Institution:	King Khalid University
College:	College of Science
Department:	Department of Chemistry

A. Course Identification and General Information

1. Course title and code: Solid State chemistry (Chem 325)
2. Credit hours: 2

3. Program(s) in which the course is offered: Bachelor of Science of Chemistry
4. Name of faculty member responsible for the course: Dr. Mutasem Zaki Bani Fawaz banifawaz@yahoo.com
5. Year or Level at which this course is offered: Year 3 (Level 6)
6. Pre-requisites for this course (if any): General Chemistry (Chem 102)
7. Co-requisites for this course (if any): None
8. Location (if not on main campus): Main Campus

B. Objectives

1. Summary of the main learning outcomes for students enrolled in the course.

- Understand the concepts of basic principles of solid state.
- Identification of crystal system and their properties, polymorphism and isomorphism
- Learn how to deal with the crystal structures , lattice , cubic unit cells , , basis , point groups , space groups , reflection cubic unit cells , Bravais lattices and lattice types.
- Understand the symmetry operators, elements and axis of rotation.
- Learn how to calculate Miller Indices of directions and planes.
- Learn how to calculate the volume of the unit cell, atomic radius, number of molecules, close packing and the density for a face, body centred cubic unit cell.
- Understand the crystal binding in solid Material.
- Study the Bragg' Law Model and learn how to calculate the cubic crystal , order of reflection , x-ray wavelength , spacing between planes and angle between incident x-ray beam and crystal planes (hkl)
- Learn the crystal defects, types of defects (point, line, surface) and how to calculate the concentrations of the defects according to types of defects.
- Learn the band theory and conduction in metallic solids
- Understand the Metallic alloys, solid solutions.
- Study the cement industry (structure , types , methods of preparations , uses)

2. Briefly describe any plans for developing and improving the course that are being implemented.

- Diversify teaching methods, such as using models for the different crystal system
- Showing animation for explaining difficult concepts such as Band theory, conduction in metallic solids.
- Continuous development to keep the contents of this course updated with the results of modern scientific research.
- Activation of more e-learning with this course by the University's website.

C. Course Description

1.1. Topics to be covered in the theoretical course.		
Topics	No. of wks	Contact Hours
*Background Review- TYPES OF CRYSTALLINE SOLIDS , Understand the concepts of basic principles of solid state , references , text book , methods of assessment , time sheet of the first , second and final exams	0.5	1
*Study the crystal structures and properties , lattice , cubic unit cells . , basis-State the crystal systems (7-crystal class).	1	2
Learn Bravais lattices (14) and lattice types.	1	2

Understand the symmetry operators , elements and axis of rotation, symmetry and point group of molecules and point group of unit cells-point groups(32) and space groups(230).	3	6
calculate the volume of the unit cell , atomic radius , number of molecules , close and square packing and the density	1	2
X- ray diffractions and Bragg's law- diffractometer . X-rays to identify materials-Intensity of diffracted beam vs diffraction angle 2θ - - structure of crystalline-Common Structures-STRUCTURE TYPE and its coordination's	2..5	5
Exam 1	0.5	1
*Learn how to calculate Miller Indices of directions and planes-calculate inter-planar spacing (d_{hkl})	0.5	1
Understand the crystal binding in solid Material- ionic and covalent materials, - lattice energy and ionic charge.	0.5	1
*Learn how to detect the crystal defects , types of defects (point , line , surface) and how to calculate the concentrations of the defects according to types of defects. Effect of impurities on the properties of semiconductors (n-type and p-type semiconductor) - methods of crystal developments.	2	4
Exam 2	0.5	1
*Learn the band theory and conduction in metallic solids	1	2
*Understand how the Metallic alloys formed from solid solutions.	0.5	1
*Study the cement industry (structure , types , methods of preparations , uses)	0.5	1
Final Exam		

2. Course components (total contact hours per semester).

Lecture	Tutorial	Laboratory	Practical/Field work/Internship	Other
30	6	0	0	0

3. Additional private study or learning hours (expected for students per week).

- 1 hour for private study in solving problems.
- 1 hour for homework assignment on black board.

4. Development of Learning Outcomes in Domains of Learning.

a. Knowledge

(i) Description of the knowledge to be acquired

- Understand the concepts of basic principles structures of solid state.
- Identification of crystal system and their properties and how different between polymorphism and isomorphism
- Learn how to calculate Miller Indices of directions and planes
- Learn how to detect the crystal defects, types of defects (point, line, surface) and how to calculate the concentrations of the defects according to types of defects.
- Understand How the Metallic alloys formed from solid solutions.
- Study everything about the cement industry

(ii) Teaching strategies to be used to develop that knowledge

- Lectures.
- Tutorials.
- Dialogue and discussion.
- Video shows
- Models for Bravais lattices and lattice types

(iii) Methods of assessment of knowledge acquired

- Three midterm and final exams that consist of the following types of knowledge questions (40% of final assessment): multiple choices, true and false, solving problems and write short notes .
- 10 % final assessment for Quizzes, open discussion as groups and homework at black board.

b. Cognitive Skills

(i) Description of cognitive skills to be developed

- Calculate the concentrations of the defects according to types of defects
- Calculate Miller Indices at different directions and planes
- Identification of crystal system and their properties such as no of molecules , coordination numbers for the different cubic systems

(ii) Teaching strategies to be used to develop these cognitive skills

- Explanations and examples given in lectures and practicing them in tutorials.
- Dialogue and discussion.
- Posting many examples and questions on the web page as homework .
- Offering the available references in the library and websites specialized in this field for the students.
- Demonstrating the different shapes for cubic systems , conduction in metals using videos
- Offering the different Models for Bravais lattices and lattice types (obtained theses models from physics' department

(iii) Methods of assessment of students cognitive skills

- Three midterm and final exams that consist of the following types of cognitive skills questions (40% of final assessment): multiple choices, true and false, fill empty space, and calculate the atomic radius , lattice parameter ...etc .
- (5 % of final assessment) : Homework assignments .
- (5 % of final assessment) : Quizzes.

c. Interpersonal Skills and Responsibility

(i) Description of the interpersonal skills and capacity to carry responsibility to be developed

- Educating student about ethics of dealing with his colleagues and with the instructors and supervisor.
- Teaching students the responsibility toward themselves and toward others.
- Working in group to make the students aware of responsibility.
- Instilling the self-learning character in the student.
- Decision-making.
- Independence.
- Work effectively.

(ii) Teaching strategies to be used to develop these skills and abilities

- Distribution students to different groups in the practical lessons to acquire skills of dealing with everyone.
- Learning student about the ethics of scientific research
- Dialogue and discussion.
- Written reports about one of topic related of the course

(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

- Assessment of assignments includes portion of grade for effectiveness of investigation processes.
- Personal performance in classroom.

d. Communication, Information Technology and Numerical Skills

(i) Description of the skills to be developed in this domain.

- The ability to communicate with me and his colleagues across all available tools .
- Enhancing the knowledge in information technology that will enable them to gather, interpret, and communicate information and ideas.
- Providing sufficient information about how to thinking to solve problems that will enable them to apply in interpreting and proposing solutions.
- Communicate via the available electronic tools.
- The use of search engines across the Web.

(ii) Teaching strategies to be used to develop these skills

- Applying the black board as effective tools for Student assignments.
- Teaching by using the e-learning tools.
- Given 5 min at the end of each lecture to selected one of students to re-mentioned again the main topics introduced in lecture

(iii) Methods of assessment of students numerical and communication skills

- Three midterm and final exams that consist of the following types of communication skills questions (40% of final assessment): multiple choices, true and false, calculate, and solve.
- Homework assignments (10% of final assessment)

e. Psychomotor Skills (if applicable)

(i) Description of the psychomotor skills to be developed and the level of performance required

- Development the ability to predicate the no of molecules at each cubic system without drawing
- Increase the ability of imagination at student to predicate the structure of molecules and atoms

(ii) Teaching strategies to be used to develop these skills

- By helping the models of X-ray with penetrating the different layers of metals and calculate the angel theta automatic according to incident and reflected lines
- Calculate Miller Indices at different directions and planes

(iii) Methods of assessment of students psychomotor skills

- Homework assignments.

5. Schedule of Assessment Tasks for Students During the Semester.

Assessment	Assessment task	Week due	Proportion of Final Assessment
1	Quizzes (short and fast 5 minutes per lecture)	Weekly	5
2	Homework Assignments (black board) , discussions is opened by groups or normal Homework (section is divided into 5 or more group sets	monthly	5
3	First Exam	6	12.5
4	Second Exam	11	12.5

5	Evaluation and one subject for each student (written and discussion) - discussions is opened by groups. Write in one of the following subject: Nano particles X-ray diffraction Magnetic particles Crystallization Liquid crystal Cement Phosphate Potash	14	5 + 5 Written and discussion
	Section is divided into groups for problems set	monthly	5
6	Final Exam	16	50

D. Student Support

1. Arrangements for availability of teaching staff for individual student consultations and academic advice.

- Office Hours: 10 hours

Total 10 hrs. of office hours for individual student consultations and academic advice per week.

Blackboard as mentioned before.

E. Learning Resources

1. Required Text(s)

- "المبادئ الأساسية في فيزياء الجوامد" لشارل كيتيل ترجمة يوسف لبيب
- الكتاب باللغة الانجليزية وهو بدقة
Charles Kittle, Introduction to Solid State Physics, John Wiley & Sons, Inc., 8th ed., 2005.

2. Essential References

Solid State Chemistry and its application" Anthony R. West , John Wiley and Son Ltd. 1985.

3. Recommended Books and Reference Material

Solid State Chemistry and its application" Anthony R. West , John Wiley and Son Ltd. 1984

U. Muller, "Inorganic Structural Chemistry", John Wiley & Sons, New York, 2nd ed., 2006.

4. Electronic Materials

<http://www.mx.iucr.org/iucr-top/comm/cteach/pamphlets/13/node5.html>
<http://img.chem.ucl.ac.uk/sgp/mainmenu.htm>
www.shef.ac.uk/.../solid-state-chemistry-applications-msc
www.simplybooks.in/solid-state-chemistry-its-anthony-r-book..
www.infibeam.com/.../solid-state-chemistry-its-applications/9...
<http://www.seas.upenn.edu/~chem101/sschem/solidstatechem.html>
<http://www.webqc.org/symmetry.php>
http://en.wikipedia.org/wiki/Molecular_geometry
http://en.wikipedia.org/wiki/Molecular_graphics
http://butane.chem.uiuc.edu/cyerkes/Chem102AEFa07/Lecture_Notes_102/newL102.htm-ecture%2014
<http://www.wyzant.com/Help>
<http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro3.htm>
<http://www.drills.com/VSEPR.php-.chemistry>
<http://www.cat.middlebury.edu/~chem/chemistry/class/general/ch103/chapter9/Test.html>
<http://kiel.de/herges/modeling/gliederung.html>
<http://scholle.oc.uni-faculty.ucsd.edu/trogler/GroupTheory224/Grouptheory.html>
<http://chem.seas.upenn.edu/~chem101/sschem/solidstatechem.html>
<http://www.phycomp.technion.ac.il/~ira/types.html>
http://en.wikipedia.org/wiki/Solid-state_chemistry
www.shef.ac.uk/.../solid-state-chemistry-applications-msc
www.simplybooks.in/solid-state-chemistry-its-anthony-r-book..
www.infibeam.com/.../solid-state-chemistry-its-applications/9...
http://books.google.com.sa/books?id=-EKcmSUQbqFC&hl=ar&redir_esc=y

5. Other learning material

. Isisdraw and Chemdraw and Chemoffice

MS-Office Software

<http://scholle.oc.uni-kiel.de/herges/modeling/gliederung.html>

<http://chem-faculty.ucsd.edu/trogler/GroupTheory224/Grouptheory.html>

<http://phycomp.technion.ac.il/~ira/types.html>

F. Facilities Required

1. Accommodation

- A classroom containing at least 45 seats and equipped with projector and Internet access (scheduled for 2 hours once a week).
- A help session classroom containing at least 45 seats and equipped with projector and Internet access (scheduled for 1 hours every week).

2. Computing resources

- Common computer lab containing at least 25 computer sets.
- High speed internet access.

3. Other resources

Isisdraw and Chemdraw and Chemoffice

Computer for individual students

Internet access

Networked laboratory systems

G. Course Evaluation and Improvement Processes

1. Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Confidential completion of standard course evaluation questionnaire.
- Focused group discussion with small groups of students.
- Review with the department chairman.

2. Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Observations and assistance from colleagues.
- Independent assessment of standards achieved by students.
- Independent advice on assignment tasks.

3. Processes for Improvement of Teaching

- Workshops on teaching methods.
- Review of recommended teaching strategies.
- Periodical department revisions on its methods of teaching by experts on the teaching.

4. Processes for Verifying Standards of Student Achievement

- 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.

5. Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- Periodic revision of the course from concerned parties in the department and college, and improving it according to what is known in distinguished universities worldwide.
- Perform the necessary changes based on the feedback from the statistical analysis of the student grades.
- Perform the necessary changes based on the feedback from the workshops, conferences, and seminars recommendations.
- Perform the necessary changes based on the feedback from the experts in the field and faculty members.