



SYLLABUS

A. Course Description

| Course Code | Course Num. | Course Name | Credit Hours | Lec. | Lab. | Tut. | Private study | Pre-requisites | Course Level | Language |
|-------------|-------------|------------------------------------|--------------|------|------|------|---------------|----------------|--------------|----------|
| CHM | 416 | Industrial Inorganic Chemistry (2) | 3 | 2 | 2 | 0 | 6 | CHM 414 | 8 | English |

The course includes basics of ceramic industries, in terms of classification, the raw materials, and advanced process in the ceramic industries. The course will extend the cement industry, glasses and the chemical reaction for their manufacturing procedure. Metallurgical Processes and Metals is one of the topics that will cover in this course. It provides information on chemical changes associated with transformation of powder cement into a solid. The practical part consists of a set of experiments that reinforce the quality control principles for the analysis of raw materials such as limestone, calcium oxide and silica.

At the end of this course the student will be able to:

- Understand the basic information for industrial requirements and methods of preparation relevant to inorganic chemistry industries.
- Develop awareness on the contributions of chemistry to industry KSA.
- Know the range and scope of the Saudi chemical industry relevant to provision of Silicate products, construction materials, oxide ceramics, and related industries
- Analyze the raw materials used in ceramics industries.

B. References:

I shall use

Industrial Inorganic Chemistry, Karl H. Buchel, Hans H. Moretto and Peter Woditsch, 2nd Ed. WILEY-VCH Verlag GmbH, D-69469 Weinheim (Federal Republic of Germany), 2000, (ISBN: 3-527-29849-5).

Students are required to purchase the textbook/materials (it is an obligation). The book contains the lecture notes as well as activities for the students to take part in; the book serves as a workbook. Other references:

Applied Chemistry, Theory and Practice, O.P. Vermani, A.K. Narula, (2nd Ed.). 1995, New Age International (P) Ltd., Publishers Published by New Age International (P) Ltd., Publishers, ISBN (13) : 978-81-224-2494-

Google Classroom Webpage: <http://www.imamm.org/>



C. Topics Outline

Disclaimer: this is a very fast-paced course. There will be little time—if any—for review. What follows is an approximate outline of the pace of the course. We may go faster or slower, contingent on the class response. The tentative list of topics to cover:

a. Theory:

- 1. Ceramics:** Ceramics, Classification of Ceramics, Traditional Ceramics, Advanced Ceramics, Ceramics Raw Materials, Naturally occurring minerals, Silicate Raw Materials, Non-Silicate Raw Materials, Synthetic Materials, Ceramic Manufacturing Processes, Traditional Processes, Body Formation, Drying and Firing, Advanced Processes, Gas-Phase Reactions, Deposition (CVD): Chemical Vapour, Liquid Precursor Methods, Homogeneous- and Co-precipitation, Polymer Pyrolysis, Sol-Gel Process, Powder Precursor Methods, Fusion Casting, Sintering.
- 2. Cement:** Cement, Nonhydraulic Cements, Hydraulic Cements, Portland Cement, Manufacturing Process, Dry process, Wet process, Burning Operation, Clinker Cooling and Grinding with Gypsum, Lime saturation factor, silica ratio and alumina ratio, Hydration of Portland Cement, Mechanism of Hydration, Through-solution hydration, Topochemical or solid state hydration, Hydration of tricalcium aluminate, Hydration of Silicates, The stoichiometric reactions for fully hydrated C3S and β -C2S, Schematic description of hydration and structure devolved in the cement paste, Types of Portland Cement, Factors Affecting the Rate of Hydration, Chemical and Sulphate Attack.
- 3. Glass:** Glasses, Composition of glass, Different varieties of glass, Vitreous Silica, Alkali silicates Lime glass, Potash lime glass, Lead glass, Borosilicate glass, Special glasses, Coloured glasses Opal, translucent, Safety or laminated glass, Fibre glass, Phosphate glass, High silica glass, Properties of glass, Physical, Chemical, different constituents of glass, Glass Raw materials, Chemical reactions of the formation, Manufacturing procedure
- 4. Metallurgical Processes and Metals:** Metallurgy of metals, Occurrence of metals, Some minerals of common metal, The main steps for the extraction of metals, Crushing and grinding, Concentration of the ore, Calcination/Roasting, Reduction, Purification, Chemical method, Smelting method, Electrolytic reduction, Reduction by precipitation, Alumino-thermic reduction, Refining of curde metals, Liquation, Poling, Distillation, Electrolytic refining, Cupellation. Copper, Occurrence, Extraction, Concentration by "froth flotation process, Smelting, Bessemerization, Refining, Poling, Electro-refining, Properties, Uses of Copper. Aluminium, Occurrence, Extraction, Baeyers process, Serpeck's process, Redaction (Hall-Heroult's Process), Purification of Aluminum (Hoop's Process), Properties, Uses. Chromium, Occurrence, Extraction, Concentration, Roasting, Reduction of the dichromate to Cr₂O₃, Reductions Cr₂O₃ to Cr, Uses, Ferrochrome, Chrome-plating, and Important chromium alloy steels. Lead, Occurrence, Extraction, Concentration, Redaction, Air-reduction method, Carbon-reduction process, Refining of lead, Fire-refining, Parke's desilverization process, Bett's electrolytic method, Properties, Uses.

b. Practical:

Lab Safety, Introduction: Analysis of calcium Carbonate Minerals, Analysis of calcium Carbonate Minerals: Determination of the percentage of loss on ignition, Determination of the Impure silica or acid insoluble matter, Determination of the amount of combined oxides impurities in carbonate ore, Determination of the amount of calcium in limestone, Determination of the water contents in cements: Determination of total water content, (W_t), Determination of chemically combined water, (W_n), Determination of Free water, (W_e), Determination of available lime or free CaO in Cement, Preparation of glass and colored glass, Coloring of glass sheet, Characterization and physical properties of glass, Determination of the durability of glass.



D. Exams & Grading System

The semi-official dates of the exams for this course, with all the caveats, that the word “semi-official” entails, can be found here:

- **Midterm 1:** 6th or 7th week & **Midterm 2:** 11th or 12th week
- **Quizzes & Homeworks:** During the semester

Your course grade will be based on Final Exam, Midterms, Homework, Quizzes, Participation, Attendance and Project.

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| Midterm 1: 10 % | Midterm 2: 10 % | Final Exam: 40 % |
| Laboratory: 30 % | Quizzes; Homework & Attendance & Participation: 10 % | |

Grading distribution:

A+: [95, 100], A: [90, 95), B+: [85, 90), B: [80, 85), C+: [75, 80), C: [70, 75), D+: [65, 70), D: [60, 65), F: [0, 60).

E. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. (“Immediate family” is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

[Executive Rules for Study Regulations and Exams](https://www.examsgoo.gl/ykm7t3)
[goo.gl/ykm7t3](https://www.examsgoo.gl/ykm7t3)

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