



University of Management & Technology

Department of Basic Sciences

Course Code: NS-113
Course Title: Chemistry for Engineers
Program: BS (EE)

Course Outline (Fall Semester 2012)

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|----------------------------------|--|---|---|
| Schedule | Monday----Saturday | Pre-requisite | Pre-Chemistry/ F.Sc. |
| Course Coordinators | Dr Sammia Shahid Dr Ayesha Mohy-ud-Din | Contact | sammia.shahid@umt.edu.pk ayesha.mohyuddin@umt.edu.pk |
| Course Description | In today's society chemistry is greatly involved in the world of engineering. Whether it is aerospace, electrical, mechanical, environmental, energy or other engineering fields, the makeup of substances is always a key factor which must be known. The more chemistry an engineer understands, the more beneficial it is. The curriculum is designed to prepare the undergraduate for work in the highly diverse engineering profession. All engineering fields have unique bonds with the chemistry. So this course provides an introduction to basic undergraduate chemistry and covers the concepts such as the periodic table, mole, stoichiometry, properties of matter & solutions, acid and bases, chemical equilibrium, chemical kinetics, transition elements, thermodynamics, electrochemistry, battery technology, fuel cell types and organic chemistry. In addition to that applied concepts are given on corrosion, polymers, metals, semiconductors, environmental pollutants and pollution control. The course is taught using a problem-solving approach. | | |
| Expected Outcomes | In future, global problems and issues will require an in-depth understanding of chemistry to have a global solution. Upon completion of this course, students will be able to understand the structure and property relationships of different engineering materials; they will be ready to meet the challenges and opportunities of creating products especially nanomaterials and processes, controlling corrosion & oxidation, manipulating complex systems, and managing technical operations in industries. | | |
| Text & Reference Book | Chemistry ,5 th edition (LPE) John McMurry & Robert C.Fay By: Pearson Education, Delhi, India, 2008 | Engineering Chemistry Gadag & Nityananda Shetty By: IK International Publications, Delhi, India | |
| Assignment & Projects | i) Problems will be assigned at regular intervals as an assignment. ii) Projects on different topics may also be assigned to the students. Marks will be deducted for late submission. | Quizzes | All quizzes will be announced. No make-ups will be offered for missed quizzes. |
| Mid Term Examination | A 60-minutes exam will cover all the material covered during the first 14 lectures. | Final Examination | A 120-minutes exam will cover all the material covered during the semester. |
| Attendance Policy | Students missing more than 20% of the lectures will receive an "F" grade in the course. | | |
| Grading Policy | Assignments + Quizzes: | 20% | |
| | Midterm: | 20% | |
| | Final: | 40% | |
| | Lab. + Projects : | 20% | |



Chemistry for Engineers (NS-113)

Lecture plan (Fall 2012)

| Week | Lecture # | TOPICS | CH | SECTIONS |
|------|-----------|---|----|------------|
| 1 | 1 | Matter & Measurement, Periodic Table | 1 | 1,3 |
| | 2 | Periodic properties, Measurement (precision & Accuracy) | 1 | 4 – 5 |
| 2 | 1 | Unit conversion calculations | 1 | 13 |
| | 2 | Quantum theories, quantum numbers & wave functions | 2 | 1 – 6 |
| 3 | 1 | Naming Chemical compounds | 2 | 7 – 10 |
| | 2 | chemical equations, Avogadro's number, Mole | 3 | 1– 4 |
| 4 | 1 | Stoichiometry Calculations, Yield of chemical reactions | 3 | 5 – 9 |
| | 2 | %age composition, Empirical formula, combustion analysis | 3 | 10 – 13 |
| 5 | 1 | Reactions in Aqueous Solutions | 4 | 1 – 6 |
| | 2 | Ionic Solids and Lattice Energy | 6 | 1– 8 |
| 6 | 1 | Thermo-chemistry, Energy conservation | 8 | 1 – 5 |
| | 2 | Thermodynamics standard state, Calorimetry, Hess's Law, Heat of formation | 8 | 6 – 10 |
| 7 | 1 | Reaction Rates, Integrated & differential rate laws, Half life | 12 | 1 – 5 |
| | 2 | 1 st order, 2 nd order and Zero order reactions, Catalysis | 12 | 6-7, 13-14 |
| 8 | 1 | Applications of Chemistry in Engineering (Nanomaterials, ceramics, polymers, surface engineering) | -- | -- |
| | 2 | | | |
| 9 | 1 | Electrochemistry, Galvanic cells, cell potentials | 17 | 1 – 4 |
| | 2 | Oxidation/Reduction, Primary, secondary & reserve Batteries | 17 | 5 – 9 |
| 10 | 1 | Fuel Cells, Electrolysis | 17 | 10 |
| | 2 | Types of Corrosion, consequences & Prevention methods | 17 | 11 – 14 |
| 11 | 1 | Chemical Equilibrium, Acid Base Concepts | 14 | 1 – 6 |
| | 2 | The pH Scale, Acid base indicators | 14 | 7 – 10 |
| 12 | 1 | Equilibria in Solutions of Weak Acids and Bases | 14 | 11 – 13 |
| | 2 | Applications of Aqueous Equilibria | 15 | 1 – 2 |
| 13 | 1 | Buffer Solutions, Common ion effect | 15 | 3 – 4 |
| | 2 | Ionization Constant, Measuring Solubility Equilibria | 15 | 11 – 13 |
| 14 | 1 | Fuels, Classification, Criteria of selection of Fuel | -- | -- |
| | 2 | Nuclear Chemistry, nuclear power & weapons | 22 | 1 – 3,10 |
| 15 | 1 | Organic Chemistry | 23 | 1 – 4 |
| | 2 | Naming Organic Compounds | 23 | 5 – 6 |



NL-113 Chemistry for Engineers Lab

Lab Work

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|------------------------------------|---|
| Lab Policy | Students are expected to perform experiments (as per attached list) related to the course work, analyze the data, draw conclusions, and write a report. Grades will be awarded based on student's lab reports and a final exam in the lab. |
| Grading Policy for Lab work | Laboratory Reports 12 Marks Final Examination 8 Marks |
| Make-up Labs | If due to an unavoidable circumstance a student has to miss a Lab, then he/she should obtain an excuse for this from the instructor. The instructor will accept an excuse only if he feels that the student had a genuine reason. In an accepted case the instructor may allow the student to take a make-up session. |
| Attendance Policy for Lab | Students missing more than 20% of the labs will receive an "F" grade in the Lab work. |

NOTE:

THERE WILL BE NO LAB. IN THE FIRST WEEK OF THE SEMESTER

OVERALL POLICY:

- Student has to pass both Course work and Lab. work.
- Student failing in the Course work but passing in the Lab. work, has to repeat both Course work and Lab. work.
- Student failing in the Lab. work but passing in the Course work, has to repeat Lab. work alone.



Department of Basic Sciences

Chemistry for Engineers

NL-113

List of Experiments

| Week | Ex No. | Title of Experiment |
|---|--|--|
| 1 st | | Introduction to general experimental and lab safety guidelines. |
| Molar Solutions of Strong Electrolytes | | |
| 2 nd | 1 | Preparation & standardization of 0.5M solution of a strong electrolyte. |
| Normal Solutions of Strong Electrolytes | | |
| 3 rd | 2 | Preparation & standardization of 0.5N solution of a strong electrolyte. |
| Kinetic Studies of Precipitation Reaction | | |
| 4 th | 3 | The study of effect of concentration & temperature on rate of a chemical reaction. |
| Gravimetric Analysis of Group II Metal | | |
| 5 th | 4 | Determination of Ba ²⁺ in an industrial sample solution gravimetrically. |
| Quantitative Analysis of Metals in Hard Water | | |
| 6 th | 5 | Determination of water hardness by Complexometric (EDTA) titration. |
| Percentage Composition of Salts | | |
| 7 th | 6 | Determine the percentage composition of each component in the mixture. |
| Percentage Purity of Metal Carbonate | | |
| 8 th | 7 | Find out the percentage purity of commercial sample of CaCO ₃ . |
| Copper Ion in Electroplating Bath Solution | | |
| 9 th | 8 | Determine the molarity of Cu ²⁺ & find number of water of crystallization in copper sulphate. |
| pH Titration of Electrolyte Mixture | | |
| 10 th | 9 | Determine the strength of the given solution of a strong acid & individual acids in a mixture by pH measurement method. |
| Electrochemistry & Nernst Equation | | |
| 11 th | 10 | Determine the cell potential (voltage) of different cells and verify by Nernst equation. |
| Electroplating & Faraday's Law of Electrolysis | | |
| 12 th | 11 | Investigate the mass transfer of copper metal during electroplating and verify Faradays law of electrolysis graphically. |
| 13 th | Makeup Classes Week | |
| 14 th | Lab. Final Examination | |
| 15 th | Week for Preparation of Theory Final Examination | |