AMERICAN INTERNATIONAL UNIVERSITY-BANGLADESH (AIUB)

Department of Natural Science (Chemistry)

Faculty of Science & Technology

Engineering Program

CHEM 1101: CHEMISTRY (3/LAB) for EEE/CoE/CSE/IPE

L E C T U R E P L A N

Spring 2023-2024_17 Weeks

CHEMISTRY THEORY LECTURES:

1st Week. *Introduction to atomic structure*: Dalton, Rutherford, Wave and Atomic spectra;

2nd Week. *Bohr atomic model*: Calculation of radius and energy of each orbit of hydrogen atom. Bohr explanation of hydrogen spectral series.

3rd Week. *Wave mechanical approach of the atom*: dual nature of matters, de Broglie's equation, Heisenberg's uncertainty principle. Orbitals, Quantum numbers and Principle of electronic configuration. (*Quiz-1*)

4th Week. *Modern periodic table*: Main features of periodic table with special reference to group chemistry, Selected topics of organic chemistry.

5th Week. *Chemical Reactions*: Concepts of acids and bases, electrolytes, oxidation-reduction, neutralization reactions. (*Quiz-2*)

6th Week. *Chemical bonds*: Main types chemical bonds, Metallic bond, Hydrogen bond.

7th Week. *Molecular orbital theory*: Main features, Bond order and Molecular orbital diagram of homonuclear and heteronuclear molecules. (Assignment-1)

8th Week. **Mid-Exam**

9th Week. *Solutions and Solubility*: Types of solution, Mechanism of dissolution, Properties of solvents, Factors affecting solubility, Gas laws: Boyle's law, Charles law, Gay-Lussac's law & Ideal gas law.

10th Week. *Solubility product & pH*: Solubility product law, Application of solubility product principle, Ionization of water, pH concept.

11th Week. *Electrochemistry*: Principle of electrolysis, Kohlrausch's Law of electrolysis, conductometric titration, electrochemical cells, photolithography. (*Quiz-3*)

12th Week. *Phase rule and phase diagram*: Phase rule and phase diagram of mono component systems. (*Quiz-5*)

13th Week. *Chemical kinetics and Chemical equilibrium*: Rate of reaction, rate laws and order of reaction; equilibrium law and its characteristics. (*Quiz-4*)

14th Week. *Thermochemistry*: Energy and its units, Enthalpy and Entropy change, Thermodynamic system & its surroundings, Heat of reactions & Fuels.

15th Week. *Solid State Chemistry*: Electrical properties of materials; Selected topics of Nano-science, Nanotechnology, Environmental Science and E-Waste etc. (Assignment-2)

16th Week. **Final-Exam**

17th Week. **Set-B Exam**

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CHEMISTRY LAB EXPERIMENTS:

Quantitative Inorganic Analysis: Volumetric titration: Acid-base titration, pH calculation, Redox titration, Estimation of Cu & Fe Total hardness of water and Conductometric titration.

1st Week. ***Introduction to chemistry laboratory***: Laboratory rules and safety guidelines, Familiarize with common apparatus (demonstration) and modern periodic table, and discussion about report writing. ***Basics of chemical analysis*** e.g., qualitative vs quantitative analysis, primary and secondary standard substances, titration, standard solution, units of concentration, calculation of concentration, etc.

2nd Week. **Expt.1:** Standardization of sodium hydroxide (NaOH) solution with standard oxalic acid (HO_2C-CO_2H, $2H_2O$) solution.

3rd Week. **Expt.2:** Standardization of hydrochloric acid (HCl) solution with standard sodium hydroxide (NaOH) solution. (*Quiz-1*)

4th Week. **Expt.3:** Standardization of hydrochloric acid (HCl) solution with standard sodium carbonate (Na_2CO_3) solution and calculation of pH.

5th Week. **Expt.4:** Determination of total Hardness of water using Eriochrome Black T (EBT) as indicator. (*Quiz-2*)

6th Week. Makeup and Review Classes.

7th Week. **Mid-term (Lab) Exam**.

8th Week. **Mid-term (Theory) Exam**.

9th Week. **Expt.5:** Standardization of sodium thiosulphate ($Na_2S_2O_3$) solution with standard potassium dichromate ($K_2Cr_2O_7$) solution.

10th Week. **Expt.6:** Estimation of copper ions (Cu^{2+}) contained in a supplied solution by iodometric method.

11th Week. **Expt.7:** Determination of ferrous ions (Fe^{2+}) in a supplied solution by standard potassium dichromate ($K_2Cr_2O_7$) solution. (*Quiz-3*)

12th Week. **Expt.8:** Determination of conductance of a weak acid against a strong alkali solution.

13th Week. **Expt.9:** Standardization of potassium permanganate ($KMnO_4$) solution with standard sodium oxalate ($Na_2C_2O_4$) solution. (*Quiz-4*)

14th Week. Makeup and Review Classes.

15th Week. **Final (Lab) Exam**.

16th Week. **Final (Theory) Exam**.

17th Week. **Set-B Exam and Results**

BOOK LIST FOR CHEMISTRY (LECTURE)

Texts: **1**. B. S. Bahl, G. D. Tuli and Arun Bahl, "Essentials of Physical Chemistry" 24th ed. (1997), S. Chand & Compnay Ltd, ISBN: 81-219-0546-X; **2**. S. Z. Haider, "Introduction to Modern Inorganic Chemistry" 2nd ed. (2000), Friends International, ISBN: 984-30-0087-0

References: **1**. M. M. Huque and M. A. Nawab, "Principles of Physical Chemistry" 3rd ed. (1974), Student Publication, ISBN: Not found; **2**. A. Q. Chowdhury, "Chemistry Fundamentals" 3rd ed. (1995), AERS & Bureau of Research, Testing and Consultation (BUET), ISBN: Not found; **3**. S. Z. Haider, "Selected Topics on Advanced Inorganic Chemistry" 4th ed. (2002), Student Publication, ISBN: Not found; **4**. B. K. Sharma, "Electrochemistry", 5th ed. (1997-98), GOEL Publishing House, ISBN: 81-85842-96-5; **5**. Maitland Jones, "Organic Chemistry", 1st ed. (1997), Norton Company, ISBN: 0-393-97079-5; **6**. Jerry March, "Advanced Organic Chemistry", 4th ed. (1999-2000), John Wiley & Sons, ISBN: 9971-51-257-2; **7**. O. P. Aggarwal, "Engineering Chemistry", 3rd ed. (1995), Khanna Publishers, Delhi

BOOK LIST FOR CHEMISTRY (LAB)

Text: **1**. M. Mahbubul Huque and A. Jabber Mian, "Practical Chemistry" 2nd ed. (1972), Student Ways, ISBN: Not found

References: **1**. J. Mendham, R. C. Denney, J. D. Barnes and M. Thomas, "Vogel'sText Book of Quantitative Chemical Analysis", 6th ed. (2000), Pearson Education Ltd, ISBN: 81-7808-538-0; **2**. G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney, "Vogel's Text Book of Quantitative Chemical Analysis", 5th ed. (1989), Longman (ELBS), ISBN: 0-582-25167-2

Evaluation Methods:

1. **Marks**: Total marks 100, Contribution of Theory 60% and Lab 40%.
   Theory (100%):
   - Class Performance & Attendance, 20%
   - Quizzes, 30% and Assignment, 10%
   - Mid/Final Exam, 40%

   Lab (100%):
   - Class Performance & Attendance, 10%
   - Quizzes, 30%
   - Reports, 20%
   - Viva, 20%
   - Mid/Final Exam, 20%
2. **Quiz**: In each term (Mid-term/Final-term) of the semester, 2 Quizzes tests and 1 Assignment will be taken in Theory Class of which *Best 1* Quiz and Assignment will count for results and *2 Quiz* tests will be taken in Lab Class of which *Best 1* will count for results.
3. **Make-up Class/Quiz**: If any schedule class is postponed in case of unavoidable situation, the make-up class will be held immediately at a suitable time. There will be no make-up quiz or lab except a strong reason for that.
4. **Grand Total**: 40% of Mid-Term + 60% of Final-Term

Course Requirements

1. Must appear at least *two quizzes* in theory and *one quiz* in lab before the Mid-term Exam and the same before the Final Exam.
2. Must appear at the Mid-term and the Final Exam both in theory and lab.
3. Students must have 80% attendance both in theory and lab to pass the course.