Pokhara University
Faculty of Science and Technology

Course Code: CHM 110
Course Title: Applied Chemistry (2-1-2)
Nature of the Course: Theory and Practical
Level: Bachelor

Full Marks: 100
Pass Marks: 45
Total Lectures: 30 hours
Program: BE

1. Course Description

This Applied Chemistry course is designed to help the engineering students to use different materials without causing any wastage or pollution thus helping the engineers in handling a wide range of materials in the right way.

2. General Objectives

The general objectives of the course are:

- To focus on the general application of chemical principles to analyse and evaluation of engineering problems such as by developing engineering materials
- To make students aware about the proper and safe handling of engineering materials to protect oneself and to the environment.

3. Methods of Instruction

Lecture, Tutorial, Discussion, Readings and Practical works

4. Syllabus in Detail

Specific Objectives	Contents
• Define the application of electrochemistry in battery-production and various types of batteries • Explain corrosion and its control measures	**Unit I: Electrochemistry and Battery Technology (6 hrs)** 1.1 Electrolytic cell and its application 1.2 Introduction to Galvanic cell and examples, electrode potential, EMF of the cell and cell representation. 1.3 Electrochemical series & its application 1.4 Electrochemical theory of corrosion and its preventions. 1.5 Batteries and their importance, Classification of batteries- primary, secondary and reserve batteries with examples. 1.6 Construction, working and applications of: Zn-Cu, Ni-Cd, Lithium-ion and Sodium ion battery.
• Identify different types of environmental pollutants, their causes, health impacts and control measures • Explain safe handling, use and disposal of engineering materials	**Unit II: Environmental Chemistry (5 hrs)** 2.1 Air, Water and Soil Pollution: causes, effects and control measures 2.2 Water Quality Analysis 2.2.1 Alkalinity 2.2.2 Hardness 2.2.3 Free Chlorine

	2.2.4 Dissolved Oxygen 2.2.5 Chemical Oxygen Demand
• Define the characteristics of transition metals which thus can be applied in designing engineering devices and products	**Unit III: Transition Elements and its Applications (4 hrs)** 3.1 Introduction to transition elements and its position in the periodic table 3.2 Characteristics of transition elements: 3.2.1 Electronic Configuration 3.2.2 Atomic radii 3.2.3 Variable oxidation states 3.2.4 Complex formation 3.2.5 Colour and Magnetic Properties 3.2.6 Catalytic property 3.3 Applications of Transition metals in various engineering fields
• Illustrate types of organic reactions, possible reaction path and its governing factors	**Unit IV: Types of Organic Reactions (4 hrs)** 4.1 Substitution reaction: SN1 and SN2 reactions, mechanism, kinetics, stereochemistry, reactivity, factors affecting this type of reaction. 4.2 Elimination reaction: E1 and E2 reactions, mechanism, kinetics, orientation (Saytzeff's rule), reactivity, factors affecting this type of reaction.
• Analyse the properties of various engineering materials • Recognize the rapidly evolving field of material chemistry and its application in the industry	**Unit V: Engineering Materials and its Applications (7 hrs)** 5.1 Explosives: Introduction, preparation, properties and applications of TNT and TNG 5.2 Cement: Types, manufacture of Portland cement setting and hardening mechanism of cement 5.3 Paints: Introduction, properties and constituents 5.4 Sensors -Introduction, basic principle and applications 5.5 Photovoltaic cells-Introduction, basic principle and applications
• Illustrate polymers as substitute materials and define their applications to various engineering fields	**Unit VI: Polymers and its Applications (4 hrs)** 6.1 Polymers 6.1.1 Addition, condensation and copolymerization 6.1.2 Preparation, properties and uses of PVC, Teflon, Silicone Rubber and Neoprene 6.2 Concept of conducting, & non-conducting, biodegradable & non-biodegradable polymers, examples and their applications

5. List of Tutorials

The following tutorial activities of 15 hours per group of maximum 24 students should be conducted to cover all the required contents of this course:

S.N.	Tutorials
1	Problems related to calculation of EMF of cell using Nernst equation.
2	Pollution issues due to air, water and soil pollutants with reference to urban areas
3	Problems related to SN1, SN2, E1 and E2 organic reactions
4	Problems related to engineering materials (manufacture and setting of cement , use and preparation of explosive, use of paints, sensor and photovoltaic cell)
5	Problems related to color, formation of complexes and magnetic properties of transition elements.

6. Practical Works (30 hours for a group of maximum 24 students)

S.N.	Practical Works
1	To determine total alkalinity of the given water sample (Two samples)-Acid-Base titration method
2	To determine the total hardness of water sample-Complexometric Titration method
3	To determine the amount of free chlorine in the given water sample- Titration method
4	To estimate DO (dissolved oxygen) in the given water sample-Winkler's method
5	To construct Zn-Cu galvanic cell and to measure EMF of the cell
6	To analyse E. Coli and total coliform bacteria in the water sample- Membrane filtration
7	Physico- chemical analysis of water samples (pH, conductivity, turbidity, total dissolved solid and suspended solid)
8	To determine pH of unknown buffer by preparing standard known buffer (Acidic and basic buffer)

7. Evaluation System and Students' Responsibilities

Evaluation System

In addition to the formal exam(s), the internal evaluation of a student may consist of quizzes, assignments, lab reports, projects, class participation, etc. The tabular presentation of the internal evaluation is as follows.

Internal Evaluation	Weight	Marks	External Evaluation	Marks
Theory		30		
Attendance & Class Participation	10%			
Assignments	20%			
Presentations/Quizzes	10%			
Internal Assessment	60%			
Practical		20		
Attendance & Class Participation	10%			
Lab Report/Project Report	20%		Semester-End examination	50
Practical Exam/Project Work	40%			
Viva	30%			
Total Internal		50		
Full Marks: 50 + 50 = 100				

Student's Responsibilities

Each student must secure at least 45% marks separately in internal assessment and practical evaluation with 80% attendance in the class in order to appear in the Semester End Examination. Failing to get such score will be given NOT QUALIFIED (NQ) to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exam, test, etc. and complete all the assignments within the specified time period. Students are required to complete all the requirements defined for the completion of the course.

8. Prescribed Books and References

Text Books

1. Maron, S. H. & Prutton, C. (2017). *Principle of Physical Chemistry*, Oxford & IBH Pub. Co.
2. Lee, J. D. (2008). *Concise inorganic chemistry*, John Wiley & Sons.
3. Morrison, R. T., & Boyd, R. N. (2012). Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.

References

1. Madan, R. D. & Prakash, S(1999). *Modern Inorganic Chemistry*, S. Chand publishing.
2. Bahl, B. S., & Bahl, A. (2017). *A textbook of organic chemistry*, S. Chand Publishing.
3. Jain and Jain (2013). *A Text Book of Engineering Chemistry,* Dhanpat Rai Publications.