**Pokhara University**

**Faculty of Science and Technology**

|  |  |  |
| --- | --- | --- |
| Course No.: xxx xxx |  | Full marks: 100 |
| Course title: Applied Chemistry (2-1-2) |  | Pass marks: 45 |
| Nature of the Course: Theory & Practical |  | Time per period: 1 hour |
| Level: Undergraduate |  | Total Periods: 30 |
|  |  | Program: BE |

1. **Course Description**

This Applied Chemistry course is designed to learn 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. There are 118 known elements available, from them this course will help to choose the best fit in solving engineering problems.

1. **General Objectives**

The general objectives of the course are:

* To focus on the general application of chemical principles to analyses 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

1. **Methods of Instruction**

General trend of the instruction for the class delivery are marker pen white board, power point, group discussion and practical observations and laboratory activities.

1. **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. Electrolytic cell and its application 2. Introduction to Galvanic cell and examples, electrode potential, EMF of the cell and cell representation. 3. Electrochemical series & its application 4. Electrochemical theory of corrosion and its preventions.    1. Batteries and their importance, Classification of batteries- primary, secondary and reserve batteries with examples.    2. 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)**   * 1. Air, Water and Soil Pollution: causes, effects and control measures   2. Water Quality Analysis * Alkalinity * Hardness * Free Chlorine * Dissolved Oxygen * 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)**   1. Introduction to transition elements and its position in the periodic table 2. Characteristics of transition elements:  * Electronic Configuration * Atomic radii * Variable oxidation states * Complex formation * Colour and Magnetic Properties * Catalytic property  1. 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)**   * 1. Substitution reaction:   SN1 and SN2 reactions, mechanism, kinetics, stereochemistry, reactivity, factors affecting this type of reaction.   * 1. 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)**   * 1. Explosives: Introduction, preparation, properties and applications of TNT and TNG   2. Cement: Types, manufacture of Portland cement setting and hardening mechanism of cement   3. Paints: Introduction, properties and constituents   4. Sensors -Introduction, basic principle and applications   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)**   * 1. Polymers * Addition, condensation and copolymerization * Preparation, properties and uses of PVC, Teflon, Silicone Rubber and Neoprene   1. Concept of conducting, & non-conducting, biodegradable & non-biodegradable polymers, examples and their applications |

1. **Tutorials**
2. Problems related to Unit I i.e., EMF of cells and batteries.
3. Pollution issues (air, water and soil with reference to urban areas)
4. Color, formation of complexes and magnetic properties of Transition elements
5. Problems related to SN1, SN2, and E1and E2
6. Problems related to Engineering materials and its applications
7. Application of Biodegradable and Non-Biodegradable polymers.
8. **Laboratory Works**
9. To determine total alkalinity of the given water sample (Two samples)-Acid-Base titration method
10. To determine the total hardness of water sample-Complexometric Titration method
11. To determine the amount of free chlorine in the given water sample- Titration method
12. To estimate DO (dissolved oxygen) in the given water sample-Winkler’s method
13. To construct Zn-Cu galvanic cell and to measure EMF of the cell
14. To analyse E. Coli and total coliform bacteria in the water sample- Membrane filtration
15. **Evaluation System and Students’ Responsibilities**

**Evaluation System**

The internal evaluation of a student may consist of assignments, attendance, test-exams, term-exams, lab reports and projects etc. The tabular presentation of the internal evaluation is as follows:

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

**Student Responsibilities**

Each student must secure at least 45% marks in internal 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) and the student will not be eligible to appear the Semester-End Examinations. Students are advised to attend all the classes, formal exams, 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.

1. **Prescribed Books and References**

**Text Books**

1. Maron, S. H. & Prutton, C. *Principle of Physical Chemistry*, Oxford & IBH Pub. Co.
2. Lee, J. D. *Concise Inorganic chemistry*; John Wiley and sons; Inc.
3. Morrison, R. T. & Boyd, R. N. *Organic chemistry*. Prentice-Hall of India Pvt. Ltd.

**References**

* 1. Madan, R. D. & Prakash, S. *Modern Inorganic Chemistry*. New Delhi: S. Chand publishing.
  2. Bahl, B. S. & Bahl, A. *A Text Book of Organic Chemistry*; New Delhi: S. Chand publishing.
  3. Jain and Jain, *A Text Book of Engineering Chemistry.* New Delhi: Dhanpat Rai Publications.