

Ramgarhia Polytechnic College,
Phagwara



Electrical Engineering Department

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| Head of Department: | Er. Jasvir Singh |
| Name of the Faculty: | Mr. Pardeep Dhiman |
| Discipline: | EE |
| Semester: | 1 st |
| Subject: | Applied Chemistry-1 |
| Lesson Plan Duration: | 16 Weeks |

RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma-engineering courses. Principles of Applied Chemistry will enable

budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.


























LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- CO1. Classify various substances based on state of aggregation
- CO2. Ascertain qualitatively few physical properties of substances such as density melting and boiling points etc qualitatively.
- CO3. Calculate qualitative and quantitative of simple chemical substances.
- CO4. Explain and substantiate the laws of chemical combinations.
- CO5 Substantiate the laws and principles on which structure of atom is established.
- CO6 Explain and predict properties of substances.
- CO7. Explain various engineering properties of substances.
- CO8. Prepare solution of required concentrations
- CO9. Prepare pH and buffer solutions and understand their significance in industrial process such as electrolysis, electrochemical machining of materials etc.
- CO 10. Explain sources of water and various characteristics of water (quantitatively).
- CO 11. Explain cause and factors which can adversely affecting natural water quality and remedial measures available for water purification to achieve water quality standards required for domestic, agricultural and industrial applications.
- CO 12. Explain the reasons for scarcity of natural water (locally and globally) on mother Earth.
- CO13. Think critically, develop and adapt water conservation techniques.
- CO14. Explain corrosion of metal and their preventive measures.
- CO 15. Classify the substance based on the electric behavior and apply these laws/principles efficiently in industrial electrochemical processes.
- CO16. Distinguish and construct electrochemical cells and electrolytic cells.

CO 17. Explain the principle and mechanisms of latest electrochemical machining technology.

CO 18. Explain various biochemical process, pollutions and their control measures polymers composites etc.

| PO → | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
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| CO17 |  | | | | | | |
| CO18 |  | | | |  | | |

Syllabus

| Units | Details | Hours |
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| 1. | <p>Basic Concept of Chemistry</p> <p>1.1 Physical Classification of matter –solids, liquids, gases.</p> <p>1.2 Chemical Classification of matter – element, compounds and mixtures</p> <p>1.3 Symbols of elements and valency, writing of chemical formulae of simple compounds.</p> <p>1.4 Calculation of percentage of elements in the following compounds using atomic and molecular masses of CaCO_3, NaCl, CuSO_4, NaOH, Ca(OH)_2, H_2SO_4, $\text{C}_2\text{H}_2\text{O}_4$. (Atomic mass of elements should be provided)</p> <p>1.5 Chemical equations, thermo-chemical equations, balancing of chemical equations (hit and trial method)</p> | (08 hrs) |
| 2. | <p>Atomic Structure, Periodic Table and Chemical Bonding</p> <p>2.1 Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles.</p> <p>2.2 Bohr's model of atom and successes and drawbacks of Bohr's Model of atom (qualitative treatment only).</p> <p>2.3 Atomic number, atomic mass number isotopes and isobars.</p> <p>2.4 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,</p> <p>2.5 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).</p> <p>2.6 Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded)</p> <p>2.7 Chemical bonding and cause of bonding and types of chemical bonding ; Ionic bond (example NaCl) and Covalent bond (sigma (σ) and pi (π) bonds) with examples of H_2, O_2, N_2 and CH_4. Elementary idea of hybridization and its types (sp^3, sp^2 & sp) with examples of CH_4, BF_3 & BeCl_2.</p> <p>2.8 Metallic bonding- explanation with the help of electron gas (sea) model.</p> | (14 hrs) |
| 3. | <p>Solutions</p> <p>3.1 Definition of solution, solute and solvent with examples</p> <p>3.2 Methods to express the concentration of solution- molarity (M), molality (m) and normality (N) and numericals based on calculation of M, m and N</p> | (08 hrs) |

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| | <p>3.3 Introduction to pH of solution, simple numericals on pH and industrial applications of pH.</p> <p>3.4 Definition of buffer solution and types of buffer solutions with examples and industrial applications of buffers solutions.</p> | |
| 4. | <p>Water</p> <p>4.1 Demonstration of water resources on Earth using pie chart.</p> <p>4.2 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL^{-1}) and part per million (ppm) and simple numericals.</p> <p>4.3 Disadvantages caused by the use of hard water in domestic and boiler feed water.</p> <p>4.4 Removal of hardness -Permutit process and Ion-exchange process.</p> <p>4.5 Chemical analysis of water for estimation of</p> <p>a) Total dissolved solids (TDS)</p> <p>b) Alkalinity of water .</p> <p>4.6 Drinking water and characteristics of drinking water.</p> <p>4.7 Natural water sterilization by chlorine and UV radiation and reverse osmosis (elementary idea).</p> | (14 hrs) |
| 5. | <p>Electro Chemistry</p> <p>5.1 Electronic concept of oxidation, reduction and redox reactions</p> <p>5.2 Definition of terms: electrolytes, non-electrolytes with suitable examples</p> <p>5.3 Faradays laws of electrolysis and simple numerical problems.</p> <p>5.4 Industrial Application of Electrolysis – Electroplating, electrolytic refining and electrometallurgy.</p> <p>5.5 Application of redox reactions in electrochemical cells – commercial dry cell (Primary), commercially used lead storage battery (Secondary cell).</p> | (14 hrs) |
| 6. | <p>Organic Chemistry</p> <p>6.1 Tetra valency and catenation property of carbon to produce huge organic compounds.</p> <p>6.2 Classification of organic compounds on the bases of functional groups</p> <p>6.3 Nomenclature of simple organic compounds in accordance with I.U.P.A.C. (compounds having two carbon atoms in a molecule belongs to alkanes, alkenes, alkynes, alkyl chlorides, alcohols, ethers, aldehydes, ketones, carboxylic acids, amines) (compounds containing more than one functional groups are excluded) and their common names (if any)</p> | (06 hrs) |

Reference Books:

1. Chemistry in Engineering by J.C. Kuricose & J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.

2. Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.
3. Eagle's Applied Chemistry - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.
5. Applied Chemistry - I by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.
6. Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, Meerut, India.

Delivery/Instructional Methodologies

| Sr.No. | Description |
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| 1. | Chalk and Talk |
| 2. | PowerPoint Presentation |

Assessment Methodologies

| Sr. No. | Description | Type |
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| 1. | Student Assignment | Direct |
| 2. | Test | Direct |
| 3. | Board Examination | Direct |
| 4. | Student Feedback | Direct |

Gaps in the syllabus - to meet industry/profession requirements

| S.NO. | DESCRIPTION | PROPOSED ACTIONS | PO MAPPING |
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| | N/A | N/A | N/A |
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Topics beyond syllabus/advanced topics

| Units | Details | Hours |
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| N/A | N/A | N/A |

Web Source References

| Sr. No. | URL |
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| 1. | https://nptel.ac.in/ |

Lesson Plan

| Week | Theory | | Practical | |
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| | Lecture Day | | Practical Day | |
| | 1 st | Physical Classification of matter –solids, liquids, gases. | | |

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| 1 st | | | 1. | Volumetric analysis and apparatus used in volumetric analysis |
| | 2 nd | Chemical Classification of matter – element, compounds and mixtures | | |
| | 3 rd | Symbols of elements and valency, writing of chemical formulae of simple compounds. | | |
| | 4 th | Calculation of percentage of elements in the following compounds using atomic and molecular masses of CaCO ₃ , NaCl, CuSO ₄ , NaOH, Ca(OH) ₂ , H ₂ SO ₄ , C ₂ H ₂ O ₄ . (Atomic mass of elements should be provided) | | |
| 2 nd | 5 th | Calculation of percentage of elements in the following compounds using atomic and molecular masses of CaCO ₃ , NaCl, CuSO ₄ , NaOH, Ca(OH) ₂ , H ₂ SO ₄ , C ₂ H ₂ O ₄ . (Atomic mass of elements should be provided) | 2. | Preparation of standard solution of oxalic acid or potassium permanganate |
| | 6 th | Calculation of percentage of elements in the following compounds using atomic and molecular masses of CaCO ₃ , NaCl, CuSO ₄ , NaOH, Ca(OH) ₂ , H ₂ SO ₄ , C ₂ H ₂ O ₄ . (Atomic mass of elements should be provided) | | |
| | 7 th | Chemical equations, thermo-chemical equations, balancing of chemical equations (hit and trial method) | | |

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| | 8 th | Chemical equations, thermo-chemical equations, balancing of chemical equations (hit and trial method) | | |
| 3 rd | 9 th | REVISION | 3. | To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator. |
| | 10 th | Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles. | | |
| | 11 th | Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles. | | |
| | 12 th | Bohr's model of atom and successes and drawbacks of Bohr's Model of atom (qualitative treatment only). | | |
| 4 th | 13 th | Atomic number, atomic mass number isotopes and isobars. | 4. | Volumetric estimation of ferrous ammonium sulfate solution by titrating it against standard potassium |
| | 14 th | Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance, | | |

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| | 15 th | Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance, | | permanganate solution in acidic medium |
| | 16 th | Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance, | | |
| 5 th | 17 th | Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded). | 5. | To prepare iodoform from ethanol or acetone. |
| | 18 th | Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded). | | |
| | 19 th | Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements | | |

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| | | with atomic number greater than 30 are excluded). | | |
| | 20 th | Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded) | | |
| 6 th | 21 st | Chemical bonding and cause of bonding and types of chemical bonding ; Ionic bond (example NaCl) and Covalent bond (sigma (σ) and pi (π) bonds) with examples of H ₂ , O ₂ , N ₂ and CH ₄ . Elementary idea of hybridization and its types (sp ³ , sp ² & sp) with examples of CH ₄ BF ₃ & BeCl ₂ . | 6. | To prepare Mohr's salt from ferrous sulfate and ammonium sulfate |
| | 22 nd | Chemical bonding and cause of bonding and types of chemical bonding ; Ionic bond (example NaCl) and Covalent bond (sigma (σ) and pi (π) bonds) with examples of H ₂ , O ₂ , N ₂ and CH ₄ . Elementary idea of hybridization and its types (sp ³ , sp ² & sp) with examples of CH ₄ BF ₃ & BeCl ₂ . | | |
| | 23 rd | Chemical bonding and cause of bonding and types of chemical bonding ; Ionic bond (example NaCl) and Covalent bond (sigma (σ) and pi (π) bonds) with examples of H ₂ , O ₂ , N ₂ and | | |

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| | | CH ₄ . Elementary idea of hybridization and its types (sp ³ , sp ² & sp) with examples of CH ₄ BF ₃ & BeCl ₂ . | | |
| | 24 th | Metallic bonding- explanation with the help of electron gas (sea) model. | | |
| 7 th | 25 th | REVISION | 7. | REVISION |
| | 26 th | REVISION | | |
| | 27 th | 1st HOUSE TEST (TENTATIVE) | | |
| | 28 th | PTM | | |
| 8 th | 29 th | Definition of solution, solute and solvent with examples | 8. | Determination of pH of given solution using pH meter |
| | 30 th | Methods to express the concentration of solution- molarity (<i>M</i>), molality (<i>m</i>) and normality (<i>N</i>) and numericals based on calculation of <i>M</i> , <i>m</i> and <i>N</i> | | |
| | 31 st | Methods to express the concentration of solution- molarity (<i>M</i>), molality (<i>m</i>) and normality (<i>N</i>) and numericals based on calculation of <i>M</i> , <i>m</i> and <i>N</i> | | |

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| | 32 nd | Introduction to pH of solution, simple numericals on pH and industrial applications of pH. | | |
| 9 th | 33 rd | Introduction to pH of solution, simple numericals on pH and industrial applications of pH. | 9. | To distinguish between aldehyde and ketone by Tollen's reagent (benzaldehyde and acetone may be used). |
| | 34 th | Definition of buffer solution and types of buffer solutions with examples and industrial applications of buffers solutions. | | |
| | 35 th | REVISION | | |
| | 36 th | Demonstration of water resources on Earth using pie chart. | | |
| 10 th | 37 th | Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL ⁻¹) and part per million (ppm) and simple numericals. | 10. | Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution |
| | 38 th | Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL ⁻¹) and part per million (ppm) and simple numericals. | | |

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| | 39 th | Disadvantages caused by the use of hard water in domestic and boiler feed water. | | |
| | 40 th | Removal of hardness - Permutit process and Ion-exchange process. | | |
| 11 th | 41 st | Chemical analysis of water for estimation of a) Total dissolved solids (TDS) b) Alkalinity of water | 11. | REVISION |
| | 42 nd | Drinking water and characteristics of drinking water. | | |
| | 43 rd | Natural water sterilization by chlorine and UV radiation and reverse osmosis (elementary idea). | | |
| | 44 th | REVISION | | |
| 12 th | 45 th | 2nd HOUSE TEST (TENTATIVE) | 12. | |
| | 46 th | PTM | | |
| | 47 th | Electronic concept of oxidation, reduction and redox reactions | | |
| | 48 th | Electronic concept of oxidation, reduction and redox reactions | | |

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| 13 th | 49 th | Definition of terms: electrolytes, non-electrolytes with suitable examples | 13. | REVISION |
| | 50 th | Faradays laws of electrolysis and simple numerical problems. | | |
| | 51 st | Faradays laws of electrolysis and simple numerical problems. | | |
| | 52 nd | Faradays laws of electrolysis and simple numerical problems. | | |
| 14 th | 53 rd | Industrial Application of Electrolysis – Electroplating, electrolytic refining and electrometallurgy. | | |
| | 54 th | Application of redox reactions in electrochemical | | |

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| | | cells – commercial dry cell (Primary), commercially used lead storage battery (Secondary cell). | 14. | REVISION |
| | 55 th | Application of redox reactions in electrochemical cells – commercial dry cell (Primary), commercially used lead storage battery (Secondary cell). | | |
| | 56 th | REVISION | | |
| 15 th | 57 th | Tetra valency and catenation property of carbon to produce huge organic compounds. | 15. | REVISION |
| | 58 th | Classification of organic compounds on the bases of functional groups | | |
| | 59 th | Nomenclature of simple organic compounds in accordance with I.U.P.A.C. (compounds having two carbon atoms in a molecule belongs to alkanes, alkenes, alkynes, alkyl chlorides, | | |

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| | | alcohols, ethers, aldehydes, ketones, carboxylic acids, amines) (compounds containing more than one functional groups are excluded) and their common names | | |
| | 60th | Nomenclature of simple organic compounds in accordance with I.U.P.A.C. (compounds having two carbon atoms in a molecule belongs to alkanes, alkenes, alkynes, alkyl chlorides, alcohols, ethers, aldehydes, ketones, carboxylic acids, amines) (compounds containing more than one functional groups are excluded) and their common names | | |
| 16 th | 61st | Nomenclature of simple organic compounds in accordance with I.U.P.A.C. (compounds having two carbon atoms in a molecule belongs to alkanes, alkenes, alkynes, alkyl chlorides, alcohols, ethers, aldehydes, ketones, carboxylic acids, amines) (compounds containing more than one functional groups are excluded) and their common names | 16. | REVISION |
| | 62 nd | | | REVISION |

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| | 63 rd | REVISION | | |
| | 64 th | 3rd HOUSE TEST (TENTATIVE) | | |