



Program : <b>Diploma in Engineering and Technology</b>	
Course Code : <b>1004</b>	Course Title: <b>Applied Chemistry</b>
Semester : <b>1</b>	Credits: <b>3</b>
Course Category: <b>Basic Science</b>	
Periods per week: <b>3 (L: 3 T: 0 P: 0)</b>	Periods per semester: <b>45</b>

### Course Objectives:

- To impart an overall knowledge in chemical bonding, water treatment, engineering materials, fuels, lubricants and Electrochemistry.
- To provide solutions to real world domestic and industrial applications.
- To equip the student in selecting appropriate materials for Engineering applications.

### Course Prerequisites:

Topic	Program / Course Name
Basic knowledge of Chemistry	Secondary School

### Course Outcomes:

On completion of the course, the student will be able to:

CO <sub>n</sub>	Description	Duration (Hours)	Cognitive Level
CO1	Explain atomic structure and chemical bonding	8	Understanding
CO2	Apply the fundamentals of analytical chemistry to solve the engineering problems and understand appropriate water treatment methods.	14	Applying
CO3	Explain various engineering materials and fuels for domestic and industrial applications	12	Understanding
CO4	Apply the concept of Electrochemistry and corrosion to solve the engineering problems.	9	Applying
	Series Test	2	



## CO – PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1							
CO2	3						
CO3			1				
CO4	3						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

## Course Outline:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
<b>CO1</b>	<b>Explain atomic structure and chemical bonding</b>		
M1.01	Illustrate the structure of atoms.	4	Understanding
M1.02	Explain the basic theoretical concepts of orbitals and facts related to it and extend the skill of writing electronics configuration of atoms.	1	Understanding
M1.03	Explain the different types of bonds in various molecules with suitable examples.	3	Understanding
<b>Contents :</b> Introduction to atomic structure, Bohr's atom model –Postulates, merits and demerits (expression of energy and radius to be omitted), dual nature of matter- de Broglie's equation, Heisenberg's uncertainty principle, simple problems based on de Broglie's equation and Heisenberg's uncertainty principle. Orbital concept, Quantum numbers, Shapes of s and p orbitals,, Pauli exclusion principle, Hund's rule of maximum multiplicity, Aufbau rule, electronic configuration of first 20 elements. Concept of chemical bonding – octet rule, types of bonds: Ionic bonding (eg: NaCl, MgO), Covalent bond (eg:H <sub>2</sub> , F <sub>2</sub> , HF), Co-ordinate bond in NH <sub>4</sub> <sup>+</sup> ions, anomalous behaviour of NH <sub>3</sub> and H <sub>2</sub> O due to hydrogen bonding.			
<b>CO2</b>	<b>Apply the fundamentals of analytical chemistry to solve the engineering problems and understand appropriate water treatment methods.</b>		
M2.01	Make use of the knowledge of concentration of solutions and volumetric analysis as a quantitative analysis in the field of science, engineering and technology	6	Applying
M2.02	Apply the physical concepts related to pH and develop the skill of solving problems	3	Applying



M2.03	Explain different types of hardness of water and the methods of removal of hardness	3	Understanding
M2.04	Explain various steps involved in municipal water treatment	2	Understanding
	Series Test - I	1	

**Contents :**

Solution – idea of solute, solvent and solution, methods to express the concentration of solution- molarity, normality and ppm. Simple problems based on molarity and normality. Ionic Product of water – pH and pOH scale Definition – relation between pH and pOH – Simple problems based on pH. Applications of pH – Buffer solution – definition – classification of Buffers – Acidic and Basic Buffers. Volumetric analysis – Titration – end point – indicators – pH range of indicators – choice of indicators in titration – Principle of Volumetric analysis(Normality equation only). Simple problems based on normality equation

Classification of soft and hard water, salts causing water hardness. Cause of poor lathering of soap in hard water. Problems caused by the use of hard water in boiler (scale and corrosion) Water softening techniques – soda lime process and ion exchange method.

Potable water and its characteristics, Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization- chlorination, bleaching, UV radiation. Flow chart for municipal supply of potable water.

<b>CO3</b>	<b>Explain various engineering materials and fuels for domestic and industrial applications</b>		
M3.01	Introduce appropriate materials in various engineering applications.	3	Understanding
M3.02	Classify the types of polymers and their applications in daily life.	3	Understanding
M3.03	Explain the terms nano materials, nanotechnology and its applications.	3	Understanding
M3.04	Classify the types of fuels and their applications.	3	Understanding

**Contents :**

Alloys – definition, purposes of alloying, Composition and application of alloys like Brass, Bronze, Duralumin and Solder. Glasses-definition, general composition, types and application (sodium silicate, borosilicate, safety glass and insulating glass) , Refractory materials – characteristics and classification with examples-acidic, basic and neutral.

Polymers – monomer, polymerisation, classification- homo and copolymers, addition polymer (polythene and PVC) and condensation polymer ( Nylon-66 and Bakelite) , thermoplastics and thermosetting plastics- with one example each. Natural rubber and vulcanization of rubber, properties of vulcanized rubber. Synthetic rubber- Buna S, Buna-N (Monomers and uses)



Definitions of nano materials and nano technology –Classification of nanomaterials based on dimension with one example each -0 D, 1D and 2 D. Carbon nanotubes (SWCNT, MWCNT), fullerenes, graphenes-(basic concept only, no classification required ) Applications of nano materials

Definition of fuel, classification of fuel (based on occurrence and physical state) with examples, characteristics of fuel, calorific values. Chemical composition, calorific values and applications of gaseous fuels-LPG, CNG and biogas.

<b>CO4</b>	<b>Apply the concept of Electrochemistry and corrosion to solve the engineering problems.</b>		
M4.01	Recall the electronic concept of oxidation and reduction	1	Understanding
M4.02	Solve problems based on Faraday's laws of electrolysis	2	Applying
M4.03	Explain electrolysis in the field of electroplating and electrolytic refining.	1	Understanding
M4.04	Explain Daniel cell and H <sub>2</sub> –O <sub>2</sub> fuel cell	2	Understanding
M4.05	Explain the methods to prevent different types of corrosion.	3	Understanding
	Series Test – II	1	

**Contents :**

Electronic concept of oxidation, reduction and redox reactions, examples. Definition of terms: Conductors (metallic and electrolytic), insulators, electrolytes – strong and weak electrolytes, non-electrolytes with suitable examples, electrolysis, electrolytic cell.-Faraday's laws of electrolysis, simple problems based on Faraday's laws.

Industrial Application of Electrolysis – Electroplating (electroplating of Nickel on mild steel) and Electrolytic refining (electrolytic refining of copper).

Electrochemical cells and classification –Primary cells, Secondary cell and fuel cell -one example each.

Application of redox reactions in electrochemical cells taking the Daniel cell as an example. Fuel cells- H<sub>2</sub>-O<sub>2</sub> fuel cell- working (with suitable diagram), applications. Electrochemical series and applications- calculation of emf. Introduction to corrosion of metals – definition, factors affecting rate of corrosion. External corrosion preventive measures:

- Barrier protection-metal (anodic, cathodic) coatings, non-metallic (anodising and anti rustsolution)
- Cathodic protection- sacrificial anode method.



### Text / Reference

T/R	Book Title / Author
R1	Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18
R2	Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
R3	C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
R4	Dara, S. S. & Dr. S. S. Umare, Engineering Chemistry, S. Chand. Publication, New Delhi, New Delhi, 2015.
R5	Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
R6	Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt. Ltd., New Delhi, 2013.
R7	Dr. G. H. Hugar & Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.
R8	Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt. Ltd., 2014.

### Online Resources

Sl. No	Website Link
1	<a href="http://www.chemguide.co.uk/atommenu.html">www.chemguide.co.uk/atommenu.html</a> (Atomic structure and chemical bonding)
2	<a href="http://www.visionlearning.com">www.visionlearning.com</a> (Atomic structure and chemical bonding)
3	<a href="http://www.chem1.com">www.chem1.com</a> (Atomic structure and chemical bonding)
4	<a href="https://www.wastewaterelearning.com/elearning/">https://www.wastewaterelearning.com/elearning/</a> (Water Treatment)
5	<a href="http://www.capital-refractories.com">www.capital-refractories.com</a> (Metals, Alloys, Cement, and Refractory Materials)
6	<a href="http://www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf">www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf</a> (Fuel and Combustion)
7	<a href="http://www.chemcollective.org">www.chemcollective.org</a> (Metals, Alloys)
8	<a href="http://www.wqa.org">www.wqa.org</a> (Water Treatment)