

# GRAPHIC ERA HILL UNIVERSITY, DEHRADUN

## SEMESTER I and II

Name of Department: - **Chemistry**

1. Subject Code: **TCH101/201** Course Title: **Engineering Chemistry**
2. Contact Hours: L: **3** T: **0** P: **0**
3. Examination Duration (Hrs): Theory **3** Practical **0**
4. Relative Weight: CWA **25** PRS **0** MSE **25** ESE **50** PRE **0**
5. Credits: **3**
6. Semester: **Autumn/Spring**
7. Subject Area: **Core Course**
8. Pre-requisite: **Basic Knowledge of Chemistry.**

<b>9. Course Outcome:</b>	<ul style="list-style-type: none"> <li>acquire knowledge of structure and properties of molecules based on bonding and spectroscopic techniques</li> <li>understand the chemistry of purification of water and its industrial and domestic application</li> <li>classify various types of polymers and their applications</li> <li>Interpret and distinguish between the different types of conventional and non-conventional fuels</li> <li>apply the basic principles of electrochemistry in different electrochemical cells, corrosion control, fuel cells and industrial applications</li> </ul>
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### 10.Details of the Course:

UNIT	CONTENTS	Contact Hrs
<b>Unit - I</b>	<b>MOLECULAR STRUCTURE AND SPECTROSCOPIC TECHNIQUES</b> Molecular Orbital Theory, Formation of homo and heteronuclear diatomic molecules Hydrogen Bonding and its application Metallic Bonding (Band theory) and application to conductors, semiconductors and insulators Nanoscale Materials - Properties and applications Basic Principles of spectroscopy and its applications for molecular structure	<b>8</b>

Unit - II	<b>WATER TECHNOLOGY</b>  Hardness of water: Causes, Types, Measurement, Boiler troubles: Sludges, Scales and Caustic Embrittlement Softening of water by L-S Process, Zeolite Process and Reverse Osmosis Process, Ion Exchange Process, Calgon Process Numerical Problems based on L-S Process, Zeolite Process and hardness of water. Introduction to the membrane concept for the treatment of microplastics from water	8
Unit -III	<b>POLYMERS</b>  <b>Polymers:</b> Definition, degree of polymerization, functionality of monomer, Classification of polymers with examples, Types of polymerizations – addition and condensation polymerization with examples. Mechanism of addition polymerization.  <b>Plastics:</b> Definition and characteristics- thermoplastic and thermosetting plastics, preparation, properties, and applications of PVC and Bakelite  <b>Fibers:</b> Characteristics of fibers – preparation, properties and applications of Nylon and Dacron.  <b>Conducting polymers:</b> Characteristics and Classification of conducting polymers with examples.  <b>Biodegradable polymers:</b> Concept and advantages – Preparation of Polylactic acid and poly vinyl alcohol and their applications.  <b>Liquid Crystalline Polymers:</b> Characteristics, classification with examples and their applications.	8
Unit –IV	<b>FUELS AND RENEWABLE SOURCE OF ENERGY</b>  Fuels Definition, Classification and Characteristics of a good fuel, Calorific value and its determination by Bomb Calorimeter, Numerical problems on Bomb Calorimeter, Composition and uses of Natural gas, CNG, LPG. <b>Renewable Energy Sources:</b> Solar energy, wind energy, hydroelectric and geothermal. Biofuels as alternative sources of energy (biomass, biogas).	8

<b>Unit-V</b>	<b>ELECTROCHEMISTRY &amp; ITS APPLICATIONS</b>  Electrode potential, standard electrode potential, factors affecting the electrode potential of a cell. Nernst equation: Electrochemical series and its application, Electrochemical cell: Daniel cell, Concentration cells, electrolyte concentration cell Numerical problems based on electrode potential and emf of a cell. Fuel Cells: Introduction, Principles, Classification, and application Corrosion its causes and effects, Theories of corrosion – Chemical & Electrochemical corrosion	<b>10</b>
	<b>Total</b>	<b>42</b>

## 10. Suggested Books:

### Text Books:

1. [Sunita Rattan](#), “Comprehensive Engineering Chemistry”, S.K. Kataria & Sons Delhi, India, 2<sup>nd</sup> Edition (2009)
2. Shashi Chawala, “Theory and Practical’s of Engineering Chemistry”, Dhanpat Rai and Company, (Pvt) Ltd 3<sup>rd</sup> Edition (2012)
3. Jain & Jain “A text book of Engineering Chemistry,” Dhanpat Rai Publishing Company, 15<sup>th</sup> Edition New Delhi (2008)

### Reference Books:

1. J.D. Lee, “Concise Inorganic Chemistry”, 5<sup>th</sup> Edition (1996)
2. K. L. Kapoor “A text book of Physical Chemistry” Vol. 5, Macmillan India, 1<sup>st</sup> Edition (2004)
3. Prof. K.N. Jayaveera, Dr.G.V.Subba Reddy and Dr.C. Ramachandraiah, “Chemistry for Engineers” McGraw Hill Higher Education Hyd., (2009)
4. William Kemp, “Organic Spectroscopy”, Palgrave Foundations, (1991).
5. L.E.Foster, “Nanotechnology, Science Innovation & Opportunity”, Pearson Education, 2007.
6. Y.R. Sharma “Elementary Organic Spectroscopy: Principles and Chemical Applications”, 1<sup>st</sup> Edition,
7. F.W.Bill, Meyer, A Text book of Polymer Chemistry, 3<sup>rd</sup> Edition 2009,
8. Thirumala Chary and Laxminarayana, “Engineering Chemistry”, Scitech Publishers, Chennai (2016).

# GRAPHIC ERA HILL UNIVERSITY, DEHRADUN

Name of Department: **Chemistry**

1.	Subject Code:	<b>PCH151/251</b>	Course Title:	<b>Chemistry Practical</b>
2.	Contact Hours:	L: <b>0</b>	T: <b>0</b>	P: <b>2</b>
3.	Examination Duration (Hrs):	Theory <b>3</b>	Practical	<b>0</b>
4.	Relative Weight:	CWA <b>25</b>	PRS <b>0</b>	MSE <b>25</b> ESE <b>50</b> PRE <b>0</b>
5.	Credits:	<b>2</b>		
6.	Semester:	<b>Autumn/Spring</b>		
7.	Subject Area:	<b>Core Course</b>		

8. Pre-requisite: **Basic Knowledge of Experiments in Chemistry**

9. <b>Course Outcomes:</b>	<input type="checkbox"/> Analyze the water and oil quality parameter. <input type="checkbox"/> Understand the concept of viscosity, surface tension and their applications. <input type="checkbox"/> Analyze the ores and bleaching powder sample <input type="checkbox"/> Knowledge of pH metric and calorimetry and their application in industry.
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10. Detailed Syllabus: Students must perform any twelve experiments:

UNIT	CONTENTS	CONTACT HRS
EXP- 1	To determine the alkalinity of the given water sample containing carbonate ( $\text{CO}_3^{2-}$ ) ions and bicarbonate ( $\text{HCO}_3^-$ ) ions by titrating it against standard HCl solution [N/10] using phenolphthalein and methyl orange as indicators.	2
EXP - 2	To determine the chloride ion ( $\text{Cl}^-$ ) content in the given water sample by Argentometric method (Mohr's method) using N/50 $\text{AgNO}_3$ as a standard solution and potassium chromate ( $\text{K}_2\text{CrO}_4$ ) as an internal indicator.	2

EXP-3	To determine the temporary and permanent hardness of given water sample by titrating it against standard solution of M/100 Ethylene Diamine Tetracetic Acid (EDTA) using Eriochrome black-T (EBT) as an internal indicator.	2
EXP-4	To determine the coefficient of viscosity of the given sample solution by Ostwald's viscometer (Viscosity of water = 0.0101 Poise).	2
EXP-5	To determine the ferrous ion ( $\text{Fe}^{++}$ ) content in given sample solution of Mohr's salt ( $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$ ) by titrating it against standard N/30 potassium dichromate ( $\text{K}_2\text{Cr}_2\text{O}_7$ ) solution by using potassium ferricyanide $\text{K}_3[\text{Fe}(\text{CN})_6]$ as an external indicator.	2
EXP - 6	To determine the surface tension of the given sample solution by drop number method	2
EXP - 7	To determine the acid value of oil	2
EXP - 8	To determine the strength of unknown HCl solution by titrating it against N/10 NaOH solution with the help of pH meter.	2
EXP - 9	Synthesis of phenol-formaldehyde resin	2
EXP – 10	To determine the alkalinity of the given water sample containing carbonate ( $\text{CO}_3^{2-}$ ) ions and hydroxide ( $\text{OH}^-$ ) ions by titrating it against standard HCl solution [N/10] using phenolphthalein and methyl orange as indicators.	2
EXP – 11	To determine the rate constant of a reaction	2
EXP – 12	To determine the Copper ( $\text{Cu}^{++}$ ) ion content in the given sample of copper ore (blue vitriol) by titrating it against standard N/30 sodium thiosulphate solution using starch as indicator by Iodometric titration.	2
EXP - 13	Determination of adsorption isotherm of acetic acid on activated charcoal	2

**Text Books:**

- [Sunita Rattan](#), “ Comprehensive Engineering Chemistry”, S.K. Kataria& SonsDelhi, India, 2<sup>nd</sup> Edition (2009)
- Shashi Chawala , “Theory and Practicals of Engineering Chemistry”, DhanpatRai and Company, India 3<sup>rd</sup> Edition (2012)