

Mechanical Engineering/ Production & Industrial Engineering/ Engineering and Computational Mechanics/ Civil Engineering/ Biotechnology/ Chemical Engineering

Course Code: CYN11502/CYN12502	Engineering Chemistry–II	Credits: 04 (L:T:P = 2:1:2)
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Prerequisites: Pre-understanding of the subject.

CO	Course Outcomes
CO1	To achieve the understanding of different fundamental chemical concepts of chemical bonding, fuel, corrosion, lubricant, polymer, water chemistry, and biochemical synthesis and process.
CO2	The ability to interpret the experimental data related to fuel, lubricant, polymer, and water chemistry. Also, understand and draw inferences related to the biochemical processes and the role of metal ions in biological systems.
CO3	Develop the capability to apply the knowledge for the industrial applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	1	-	-	-	1	1	1	1
CO2	2	2	1	1	2	-	-	-	1	2	2	1
CO3	2	2	1	1	1	-	-	-	1	1	1	1

Module	Content	Lectures
1.	Chemical Bonding: Drawbacks of Valence bond theory, Molecular orbital theory of small molecules, bonding in metals, semiconductors, and insulators, impurity semiconductors, symmetry, symmetry elements, point groups and group theory.	06
2.	Fuels: Classifications, calorific values, analysis of solid fuels, liquid fuels and their properties, refining, cracking and reforming of petroleum, knocking and octane rating, biofuels.	04
3.	Corrosion and Lubricants: Causes and effects of corrosion, theories of corrosion, types, factors of corrosion, its prevention and control, case study on corrosion control in industry. Corrosion and lubricant relation, functions of lubricants, tribology and lubrication, classification, mechanism and testing of lubricants.	06
4.	Polymers: Classification (origin: natural, synthetic, semi-synthetic, biopolymers (natural & synthetic) and biodegradable polymers), types: plastics, rubber, fibre, adhesives, composites, thermoplastic and thermosetting polymers, characterization and properties, industrial uses.	06
5.	Water Chemistry: Importance of water, sources of impurities and their treatment processes, hard water, alkalinity of water, softening of water, boiler feed water, boiler corrosion, prevention of scale formation, break point of chlorination, modern water purification systems.	06

6.	Biochemical Synthesis and Process: Introduction, manufacture of ethyl alcohol and acetic acid by fermentation, role of metal ions (Fe and Co) in biological systems.	02
	Practical: List of Experiments	
	Part A:	
	<ol style="list-style-type: none"> To determine the percentage of available chlorine in the supplied sample of bleaching powder. To determine the total hardness, Ca^{2+} hardness, and Mg^{2+} hardness in the supplied water sample by titrating with standard EDTA solution. To determine the alkalinity of the supplied water sample. To determine the strength of supplied $\text{K}_2\text{Cr}_2\text{O}_7$ solution using Ferrous Ammonium Sulphate solution as intermediate and Potassium Ferricyanide solution as an external indicator. Preparation of Methyl Orange using a diazonium coupling reaction. 	
	Part B:	
	<ol style="list-style-type: none"> Determination of flash point of oils by Abel's apparatus. Determination of flash point of lubricating oil by Pensky-Martens closed cup tester. To study the kinematic viscosity of the given lubricating oil at various temperatures using a Redwood viscometer. To find out the aniline point of the given fuel samples. Determination of viscosity average molecular weight of a polymer sample by Ostwald Viscometer. 	
	Part C:	
	11. Preparation and characterization of biodiesel from waste cooking oils.	

Text Books:

- Engineering Chemistry*, Jain & Jain, 2013, Dhanpat Rai Publishing Co., New Delhi.
- Engineering Chemistry*, Shashi Chawla, 2017, Dhanpat Rai Publishing Co., New Delhi.

Reference Books:

- Inorganic Chemistry: Principles of Structure and Reactivity*, James E. Huheey, Ellen A. Keiter, Richard L. Keiter, and Okhil K. Medhi, 2006, Pearson Education, India.
- Chemical Applications of Group Theory*, F. Albert Cotton, 2003, John Wiley & Sons, New Jersey, USA.
- Elements of Physical Chemistry*, Peter Atkins and Julio D. Paula, 2006, Oxford, UK.
- Engineering Chemistry - A Textbook*, Harish Kumar Chopra and Anupama Parmar, 2007, Narosa Publishing House Pvt. Ltd., New Delhi.
- Polymer Science*, V R Gowariker, N V Viswanathan, and Jayadev Sreedhar, 2021, New Age International Private Limited, New Delhi.
- Biochemical Methods*, A. Pingoud, C. Urbanke, J. Hoggett, and A. Jeltsch, 2002, Wiley-VCH Verlag GmbH, UK.
- Online resources*.