Annexure-I

Program	**B. Tech. CSE/ All Specialisation Programs**				
Year	**I**	**Semester**		**I/II**	
Course Name	**Engineering Chemistry**				
Code	**NBS4103/NBS4203**				
Course Type	**BSC**	**L**	**T**	**P**	**Credit**
Pre-Requisite	Knowledge of Basic Concepts of Chemistry	**3**	**1**	**0**	**4**
Course Objectives	To provide fundamental building blocks and a spatial learning approach using engineering chemistry models, photographs and other visual aids. To concentrate on the production and application of diverse polymers and impart a foundational understanding of various fuels.				
Course Outcomes					
CO1	To understand the role of chemistry in field of engineering.				
CO2	To understand the structure of atoms and apply the knowledge in solving problems in their respective field of study.				
CO3	To develop analytical capabilities and techniques of interpretation.				
CO4	To employ critical thinking and efficient problem-solving skills in the basic areas of chemistry.				

Module	Course Contents	Contact Hrs.	CO Mapping
I	**Atomic Structure and Chemical Bonding:** Significance of Quantum numbers, Molecular Orbital theory and its Applications in Homonuclear and Heteronuclear diatomic molecules. **Reactions kinetics:** Rate equation, Order and Molecularity of reaction. Theories of reaction rates, Integrated rate equations. **Electrochemistry:** EMF of the cell, Electrode Potential, Nernst equation and its importance. **Allotropes of Carbon:** Structure and applications of Fullerenes and Graphite. **Nanomaterials:** Types of Nanomaterial, Synthesis (Sol gel method), Carbon Nanotube and its application. **Solid State:** Space lattice, Types of unit cell (cube), Density of unit cell, Defects in crystal. **Liquid crystal** and its application.	15	CO 1 CO 2
II	**Stereochemistry:** Concept and Types of Isomerism, Optical isomerism: Molecular chirality, optical activity, chiral and achiral molecules with two stereogenic centers, Properties of Enantiomers and Diasteroisomers. Relative and absolute configuration: R & S systems of nomenclature. Geometric isomerism: E & Z system of nomenclature using CIP Rules. Conformational isomerism: Conformational analysis of n-Butane. **Green Chemistry:** Introduction of Green Chemistry and its 12 principles.	15	CO 1 CO 2 CO 3
III	**Principles of Polymer Chemistry** Introduction of Polymer: Classification of Polymers,	15	CO 1 CO 2

	Mechanism of addition polymerization, Thermoplastic and Thermosetting resins, Molecular weight of polymers. Natural Rubber, New Innovations: Bio-composites, Bio-plastics, Degradability, Dioxin, Furan, Persistant Organic Pollutants (POPs) and Endocrine Disrupting Chemicals (EDCs). Synthetic Fibers: Nylon-6, Nylon-6, 6, Kevlar, Dacron, Bakelite, PTFE. Organic Conducting polymers: Polyacetylene, Polythiophene, Polypyrrole, Polyaniline. Biodegradable polymers, Plastics and Polymers safety aspects and usage, Particulate Matters ($PM_{2.5}$ and $PM_{20.0}$).		CO 3
IV	**Analytical techniques:** Ultraviolet Spectroscopy (UV): Types of Transition, Chromophores and Auxochromes, Bathochromic and Hypsochromic Shift. Classical and Hybrid Analytical Techniques (State of Art): Principles and Operation of High Performance Liquid Chromatography (HPLC). **Water Technology:** Sources and impurities of water, Hardness of water, Techniques for water softening: Zeolite process. Monitoring and Management of Water and safe water supply. **BIS** (Bureau of Indian Standards) and regulatory norms (IS:10500, IS 14543, IS 13428), ISO/IEC17025:2017. **Biofuels** and its importance.	15	CO 1 CO 4

Text Book:

1. Shashi Chawla, A Text book of Engineering Chemistry,8th edition Dhanpatrai & Co. (P) Ltd., 2013.
2. R. K. Agarwal: Engineering Chemistry, 16th edition, Krishna Publication (P) Ltd, 2019.
3. I.L. Finar, Organic Chemistry, 6th edition, Pearson, 2011.
4. V. K. Ahluwalia, Green Chemistry, Narosa Pub. House (P) Ltd., 2013.
5. Puri, Sharma and Kalia, "Principles of Inorganic Chemistry" 33rd edition, Vishal Publication Co., 2020.
6. Puri, Sharma and Pathania, "Principles of Physical Chemistry" 48th edition, Vishal Publication Co., 2022.

Suggested Readings:

1. Arun Bahl and B. S. Bahl , Advanced organic chemistry,S.Chand,2010
2. Charles P Poole, Frank J Owens, Introduction to nanotechnology, John Wiley &sons, 2007
3. Atkins P and de Paula J, *Physical Chemistry* (8th ed., W.H. Freeman 2006)

Online Source:

1. https://www.youtube.com/playlist?list=PL5oCdOafm7vQJVPaa5TKcv9sZGh5fROjr (Module I)
2. https://www.youtube.com/playlist?list=PLOzRYVm0a65flGJp8FKlBbEP2VA9p6Q4g (Module I)
3. https://www.youtube.com/playlist?list=PLFW6lRTa1g82yuaxHUfC72ZPBViN95T-D (Module I)
4. https://www.youtube.com/playlist?list=PLyqSpQzTE6M936966RyQjOXvv1QlhZW3H (Module II)
5. https://www.youtube.com/playlist?list=PL_a1TI5CC9RGfGBeLh4GEFxZ8VPSZdwQ3 (Module II)
6. https://www.youtube.com/playlist?list=PL400CAFBA72E94CF8 (Module III)
7. https://www.youtube.com/watch?v=m79g4DOdNi4&t=2466s (Module III)
8. https://www.youtube.com/playlist?list=PLbMVogVj5nJT0slH3tuas5BIp1DG8ZpMj (Module IV)

Program	B. Tech CSE/ All Specialisation Programs				
Year	I	Semester		I/ II	
Course Name	Engineering Chemistry Lab				
Code	NBS4153/NBS4253				
Course Type	BSC	L	T	P	Credit
Pre-Requisite	Basic Knowledge of Chemistry	0	0	2	1

S. No.	List of Experiments
1	Determination of constituents and amount of alkalinity of supplied water sample.
2	Determination of total hardness of water by complexometric titration method.
3	Determination of chloride content in a given sample of bleaching powder.
4	Determination of chloride content in supplied water sample using Mohr's method.
5	Determination of iron content in the given water sample by using external indicator.
6	Determination of pH of a solution using a pH meter and titration of such a solution pH metrically
7	Detection of functional group present in given organic compound.

Suggested Readings:

1. Textbook of practical chemistry, A.I. Vogel, Prentice Hall, 5th edition.
2. Vogels quantitative chemical analysis, A.I, Vogel, Prentice hall, 6th edition.
3. Practical organic chemistry, F.G. Mann & B.C. Saunders, orient longman,1960.

Online Source:

1. https://ee1-nitk.vlabs.ac.in/exp/determination-of-alkalinity/theory.html
2. https://ee1-nitk.vlabs.ac.in/exp/determination-of-hardness/
3. http://vlabs.iitb.ac.in/vlabsdev/labs/nitk_labs/Environmental_Engineering_1/experiments/determination-of-chloride-nitk/simulation.html
4. https://vlab.amrita.edu/?sub=2&brch=191&sim=345&cnt=1