

## DEPARTMENT OF CHEMISTRY

### MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

#### Engineering Chemistry

All branches I/II Semester B.Tech (Core course)

#### DETAILS OF THE COURSE

Course Code	Course Title	Credits	Lecture	Tutorial	Practical	Studio
CYT101	Engineering Chemistry	3	2	1	0	0

#### PREREQUISITE

Basic knowledge about inorganic salts and chemical analysis

#### COURSE OBJECTIVE(s)

Engineering Graduates will be able to:	
1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to solve complex engineering problems.
2	<b>Problem analysis:</b> Identity, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3	<b>Design/development of solutions:</b> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, societal, and environmental considerations.
4	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods, including the design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	<b>Modern tool usage:</b> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.
6	<b>The engineer and society:</b> Apply to reason informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7	<b>Environment and sustainability:</b> Understand the impact of professional engineering solutions in societal, and environmental contexts and demonstrate the knowledge and need for sustainable development.
8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	<b>Individual and team work:</b> Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10	<b>Communication:</b> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	<b>Life-long learning:</b> Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### COURSE OUTCOME:

CO1	Understand the fundamentals of water chemistry and novel treatment procedures of wastewater from domestic and industrial sources
CO2	Understand the fundamentals of solid/liquid/gaseous fuels and non-conventional energy sources, and the methods to extract maximum energy from fuels
CO3	Understand the basics of lubrication, types of lubricants and their applications, and the essentials to develop highly efficient lubricants
CO4	Understand the New Engineering Materials and their applications in advanced engineering solutions
CO5	Understand the concepts of corrosion and techniques to control corrosion
CO6	Understand the chemical structures of materials and appreciate their design in advanced functional materials useful in energy applications for a sustainable future.
CO7	Understand and apply spectroscopic techniques to advanced engineering problems

## COURSE ASSESSMENT

The Course Assessment (culminating to the final grade), will be made up of the following three components;

S. No.	Component	Weightage
(a)	Tutorial Evaluation/Assignments	20%
(b)	Mid-term examination	30%
(c)	Practical Examination	NA
(d)	End Semester Examination	50%

## COURSE CONTENTS

Lecture Plan (Hrs.)	Course Content
Unit 1 (8 L)	<p><b>Water and its treatment:</b> Hardness, Types of hardness, Units of hardness, and Methods of estimation of hardness.</p> <p><b>Removal of Hardness (Softening Methods):</b> Lime Soda process, Permutit or Zeolite process and Deionization or Demineralization process.</p> <p><b>Municipal Water Supply:</b> Purification of water by various methods, Detailed study of methods of Disinfection, Removal of heavy metals from industrial wastewater.</p>
Unit 2 (2 L)	<p><b>Lubricants:</b> Introduction of lubricants and lubrication. Types of the mechanism of lubrication, Uses and properties of lubricants viz. Viscosity &amp; Viscosity index.</p>
Unit 3 (4 L)	<p><b>Fuels and Combustion:</b> Classification and properties of fuels, Calorific value, Petroleum: refining and fractional distillation of crude petroleum, Cracking, Synthetic petrol, Knocking and anti-knocking agents, octane and cetane number, Gaseous fuels and hydrogen fuels.</p>

Unit 4 (3 L)	<b>New Engineering Materials:</b> Organic/hybrid photovoltaic materials, Conducting polymers, Introduction to nanotechnology and nanomaterials (fullerenes and quantum dots).
Unit 5 (4 L)	<b>Corrosion:</b> Introduction, theory, and mechanism of of corrosion, galvanic and differential aeration corrosion, various preventive measures to control corrosion.
Unit 6 (3 L)	<b>Advanced electrochemical systems:</b> Introduction to energy storage devices, Li-ion batteries, redox flow batteries, fuel cells, H <sub>2</sub> -O <sub>2</sub> fuel cells.
Unit 7 (4 L)	<b>Spectroscopy:</b> Introduction, classification, and applications, Ultraviolet-Visible, Infra-Red, and Nuclear Magnetic Resonance Spectroscopy.

#### TEXT BOOKS/ REFERENCE BOOKS

Recommended Text Books	<ol style="list-style-type: none"> <li>1. Engineering Chemistry: A Text book by P.C. Jain, Dhanpat Rai &amp; Sons.</li> <li>2. A Text book of Engineering Chemistry by Shashi Chawla, Dhanpat Rai and Sons.</li> <li>3. Engineering Chemistry: A Text book by S.S. Dara, S. Chand &amp; Co.</li> <li>4. Solid State Chemistry and its Applications by Anthony R. West, Wiley 2014</li> <li>5. Modern Batteries by C.A. Vincent and B. Scrosati, Elsevier 1997.</li> <li>6. P.S. Kalsi, Spectroscopy of Organic Compounds, New Age International (P) Ltd. Publishers</li> <li>7. Fundamentals of Molecular Spectroscopy by Colin Banwell and Elaine McCash, Tata McGraw Hill Education Pvt. Ltd.</li> </ol>
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