Semester	**:**	**III**	
Course No.	**:**	**REE-232**	**Credit Hrs. : 3(2+1)**
Course Title	**:**	**Engineering Chemistry**	

SYLLABUS

Objectives : (i) To make the students acquainted with applications of Chemistry in Engineering,
(ii) To study different chemical processes in Agricultural and Food Engineering.

THEORY

Phase rule: Phase, component, degree of freedom, Application to one component system, viz. Water system, Sulphur system, Two component system, viz. Pb-Ag system, Desilverisation of Pb; **Colloids:** Classification, Properties like Optical activity- Tyndall effect, Brownian movement, Electrical properties-electrophoresis, Causes, Types and Methods of prevention- Proper designing. **Corrosion:** Cathodic protection using pure metal and metal alloys, Use of inhibitors. **Water:** Temporary and permanent hardness, Disadvantages of hard water, Scale and sludge formation of boilers, Boiler corrosion, Basic idea on thermo-gravimetric analysis, Polarographic analysis, Nuclear radiation, Detectors and Analytical applications of radio-active materials, Discovery of isotopes and new elements, release of atomic energy, radio-active tracer, and carbon dating; **Fuels:** Classifications, Calorific value and its determination by bomb calorimeter. **Principles of Food Chemistry:** Lipids, Proteins, Carbohydrates and their Classifications, Vitamins and their Importance. Enzymes and Co-enzymes Importance in Food processing and storage, their use in manufacturing of ethanol and acetic acid by fermentation method; Introduction to food preservatives, definition, Types: Natural and Artificial preservative and its use, Colouring and flavoring reagents of foods. **Lubricants:** Classifications, Properties- Viscosity, flash point and fire point mechanism, thick film, thin film and extreme pressure, neutralization point, saponification number and mechanical stability. Type of Polymerization with Examples (addition, free radical); Different Properties of Polymers- Chemical resistance, Crystallinity. **Polymers:** Effect of heat on polymers, General use, Basic principles of determination of molecular weight by viscosity methods, Basic principles of determination of molecular weight by light scattering methods. **Introduction to IR spectroscopy:** Basic principles of Spectroscopy, Beer-Lambart's law, Types of vibration, symmetric, asymmetric vibration, Absorbances of different functional group in IR.

PRACTICAL

To determine temporary and permanent hardness of water by EDTA method; To estimate chloride in water sample; To estimate dissolved oxygen in water sample; To study the different types of fuels and compare their characteristics; To study different types of foods and their ingredients; To study the different types of food preservatives and their active principles; To study the different properties of lubricants; To determine λmax and verification of Beer-Lambert law.

TEACHING SCHEDULE

THEORY [REE-232]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1 - 3	Phase Rule	• Definition - • Explanation of Terms Phase Rule- • Component & Degree of freedom- • Application to: - One component system viz; Water system and Sulphur System - Two component System viz; Lead-Silver System (Pb-Ag) • Desilverisation of Pb-	15
4 - 5	Colloids	• Classification- • Optical properties- Optical activity, Tyndall effect, Brownian movement • Electrical properties- Electrophoresis, Causes, Types, and Methods of prevention- Proper designing	15
6	Corrosion	• Cathodic protection using pure metal and metal alloys, • Use of inhibitors.	
7 - 8	Water	• Hardness of water; Temporary and Permanent hardness; Disadvantages of hard water • Scale and sludge formation in boilers; Boiler corrosion	20
9 - 10	Thermo-gravimetric & Polarographic Analysis	• Basic idea on thermo-gravimetric analysis and Polarographic analysis	
11 - 13	Nuclear Chemistry	• Nuclear radiation, Detectors and Analytical applications of radio-active materials • Discovery of isotopes and new elements, Release of atomic energy, Radio-active tracer and Carbon dating	
14 - 15	Fuels	• Classifications of Fuels • Calorific value and its Determination by Bomb calorimeter	20
16 - 18	Principles of Food Chemistry	• Lipids, Proteins, Carbohydrates and their Classifications, Vitamins and their importance	
19 - 20	Enzymes and Co-enzymes	• Important in Food processing and storage, • Use in manufacturing of ethanol and acetic acid by fermentation method	
21 - 22	Food Preservatives	• Introduction of Food Preservatives- • Definition, Types- • Natural and Artificial preservatives and its use, Colouring and flavoring regents of foods.	

Continued…

23 - 25	Lubricants	• Function • Mechanism of lubrication- fluid film or thick film, boundary lubrication of thin -film and extreme pressure lubrication. • Classification • Properties of lubricating oils viz., Viscosity, flash point and fire point mechanism, thick film, thin film and extreme pressure neutralization point, saponification number and mechanical stability	15
26 - 27	Polymerization	• Type of Polymerization with Examples (Addition, Free radical); • Different properties of Polymers- Chemical resistance, Crystallinity	15
28 - 30	Polymers	• Effect of heat on polymers, General use, • Basic principles of determination of molecular weight by viscosity methods, • Basic principles of determination of molecular weight by light scattering methods	
31 - 32	IR Spectroscopy	• Introduction to IR spectroscopy • Basic principles of spectroscopy, Beer-Lambart's law, • Types of vibration: Symmetric, Asymmetric vibration, • Absorbances of different functional group in IR.	
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [REE-232]

Exercise No.	Exercise Title
1 - 2	To determine the temporary and permanent hardness of water by EDTA method
3	To estimate chloride in water sample.
4	To estimate dissolved oxygen in water sample.
5 - 6	To study the different types of fuels and compare their characteristics.
7 - 8	To study of Proximate and Ultimate analysis of selected biomass.
9 - 10	To study of calorific value of solid and gaseous fuel.
11	To study the different types of food preservatives and their active principles.
12	To study different types of foods and their ingredients.
13 - 14	To study the different properties of lubricants.
15 - 16	To determine λ_{max} and verification of Beer-Lambert's Law.

Suggested Readings [REE-232]:

1. Jain P.C. and Jain Monika. 2016. *Engineering Chemistry*. Dhanpat Rai Publication.
2. Jain P.C. and Jain Monika.1994. *Engineering Chemistry*. Dhanpat Rai publishing company Pvt. Ltd., Delhi.
3. Bahl B.S., Bahl A. and Tuli B.D. 2007. *Essentials of Physical Chemistry*. S. Chand and Co. Ltd., New Delhi.
4. Finar I.L. 2002. *Organic Chemistry*, *Vol I and II*. Pearson.
5. Glasstone S. *Elements of Physical Chemistry*. The Macmillan Company of India Limited.
6. Morrison R.T., Boyd R.N. and Bhattacharjee S.K. 2010. *Organic Chemistry*. Pearson.
7. Sharam Y.R. 2013. *Elementary Organic Spectroscopy*. S. Chand Publishing.