GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

ENGINEERING CHEMISTRY
(Code: 3316304)

Diploma Programme in which this course is offered	Semester in which offered
Agricultural Engineering	First

1. RATIONALE.

Science is the foundation for all technician courses. The basic aim of teaching science is to develop in the students the habit of scientific inquiry, ability to establish the cause and effect, relationship. Chemistry forms the part of applied science .The study of basic concepts of chemistry like Phase rule, corrosion, water treatment, Organic chemistry and different engineering materials like polymers, adhesives, paints, lubricants, etc. will help the students understanding engineering subjects where the emphasis is laid on the application of these concepts Chemistry is concerned with the changes in structure and properties of matter. Many of the process which are involved to bring out this changes forms the basis of engineering activities.

2. COMPETENCY.

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies…….

- Analyze properties of material & their use for the selection of material mostly applicable for engineering users..
- Follow the principles used in the physical properties, its measurement and selections.

3. COURSE OUTCOMES.

- The student will demonstrate the ability to think in core concept of their engineering application by studying various topics involved in branch specific applications.
- The student will demonstrate the ability to use appropriate mathematical techniques and concepts to obtain quantitative solutions to problems
- In courses involving laboratory, the student will demonstrate the ability to collect and analyze data and to prepare coherent reports of his or her findings.
- In a design module project , the student will demonstrate the ability to perform a literature search, to make use of appropriate computational or laboratory skills, and to make an effective written or oral presentation of the results of the project.

4. TEACHING AND EXAMINATION SCHEME.

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
03	00	02	05	70	30	30	20	

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical;

C – Credit, ESE -End Semester Examination; PA - Progressive Assessment

5. COURSE DETAILS.

Unit	Outcomes (in cognitive domain)	Major Learning Topics and Sub-topics
Unit – I Phase Rule	1.1 Understand the term Phase rule 1.2 Understand the different terms of Phase rule 1.3 State the Phase rule 1.4 Explain the construction of Phase diagram 1.5 Describe the one component system using Phase rule with example 1.6 Describes the Two component system using phase rule with example	1.1Introduction –phase rule 1.2 Explanation of terms: Phase, Component, Degree of Freedom 1.3 Mathematical statement of Phase rule (Gibbs Phase rule) 1.4 Construction of Phase diagram. 1.5 One component system- Water system 1.6 Two component system-classification 1.6.1 Lead-silver system 1.6.2 Phase rule Application
Unit-II Fuels and Calorific value	2.1 Explain the term Fuel 2.2 Describe the different Characteristics of fuel 2.3 Classify different fuels 2.4 Determinate calorific value	2..1 Introduction-Fuel 2.2 Characteristics of Good fuel 2.3 Classification of Fuels 2.4 Calorific Value 2.4.1 Units of Calorific Value 2.4.2 Dulong Formula for Calorific Value and example 2.4.2 Higher Calorific Value and Lower Calorific Value
Unit-III Colloids and Enzymes	3.1 Understand the colloidal system 3.2 Describe the different types of colloidal system 3.3 Explain the different properties of colloidal systems. 3.4 Explain Enzymes and their different characteristics. 3.5 Describe the manufacturing process of ethanol and acetic acid by	3.1Colloids-Definition 3.2 Classification of colloids-lyophilic and lyophobic sols 3.3 Properties of colloidal systems 3.4 Enzymes-Definition 3.4.1 Characteristics of Enzymes 3.4.2 Some example of Enzyme Catalyze reaction 3.5 Manufacturing of Ethanol and acetic acid by fermentation method (definition of fermentation, Factors affecting process of fermentation).

Unit	Outcomes (in cognitive domain)	Major Learning Topics and Sub-topics
	fermentation process.	
Unit-IV Corrosion and its prevention	4.1 Describe the different types of corrosion 4.2 Comprehend the different factors affecting rate of corrosion 4.3 Understand the different types of corrosion 4.4 Explain the different Protective measures to prevent the corrosion	4.1 Corrosion –Definition 4.2 Causes of Corrosion-factors affecting rate of corrosion. 4.3 Types of Corrosion 4.3.1 Pitting Corrosion 4.3.2 Water line Corrosion 4.3.3 Crevice corrosion 4.3.4 Soil Corrosion 4.3.5 Erosion corrosion 4.3.6 Microbiological corrosion 4.4 Method to Prevent corrosion 4.4.1 Modification of environment, Modification of the properties of metal, Use of prot ective coatings. Anodic and cathodic protection, Modification in design and choice of material
Unit-V Water Hardness	5.1 Differentiate between hard water & soft water 5.2 Explain the different units to define hardness 5.3 Describe the ill effect of hard water in boiler Operation 4.3 Explain the different methods for removal of hardness in water	5.1 Water Types and types of hardness 5.2 Units of Hardness 5.3 Effect of hard water 5.3.1 Scale and sludge formation and it's Prevention 5.3.2 Priming and foaming and it's prevention. 5.3.3 Caustic embrittlement and it's prevention. 5.4 Boiler corrosion and its prevention
Unit-VI Analytical Methods	Describes the different thermal analytical methods to determine the properties of substance	6.1 Thermal Methods of analysis 6.2 Thermo gravimetric methods 6.3 Polarographic methods
Unit-VII Nuclear Chemistry	7.1 Describe the phenomenon of radioactivity. 7.2 Describe the different types of radioactivity. 7.3 Explain the nuclear radiation detectors 7.4 Describe the analytical application of nuclear radiation.	7.1 Introduction-Radioactivity 7.2 Types of Radioactive decay 7.3 Nuclear radiation detectors 7.4 Analytical application of nuclear radiation

Unit	Outcomes (in cognitive domain)	Major Learning Topics and Sub-topics
Unit- VIII Food Chemistry	Understand the concept of food chemistry and how they are used.	8.1 Principles of food chemistry 8.2 Introduction to lipids, proteins, carbohydrates, vitamins, food preservators, colouring and flavouring reagents of food
Unit-IX Lubricants	9.1 Define terms Lubrication and Lubricants 9.2 Define the different types of lubricants 9.3 Define the physical and chemical property of Lubricants	9.1 Introduction-Lubricants 9.2 Classification of lubricants - Solid lubricants Semi-solid lubricants, Liquid lubricants, Synthetic oils 9.2 Mechanism of lubrication- Fluid film Lubrication And Boundary lubrication 9.3 Properties of Lubricants and their test 9.3.1 Viscosity and viscosity index 9.3.2 Flash point and fire point 9.3. 3 Pour point and cloud point 9.3.4 oiliness 9.3.5 Chemical Properties of lubricants like 9.3.6 Saponification value 9.3.7 Neutralization number 9.3.8 Emulsification number
Unit- X Polymers	10.1 Explain the terms Polymer and polymerization 10.2 Explain the different types of Polymerization process 10.3 Describes the different properties and uses of polymers 10.4 Describes the different methods to determine the molecular weight of polymers	10.1 Introduction –Polymer and Polymerisation 10.2 Types of Polymerization – Addition and Condensation Polymerization 10.3 Properties and uses of Polymers 10.4 Methods to determine the molecular weight of polymer 10.4.1 Number Average molecular mass 10.4.2 Weight average molecular mass 10.4.3 Viscosity average molecular mass

6. SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY).

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Phase Rule	04	02	04	02	08
2	Fuels and Calorific Value	02	02	02	02	06
3	Colloids and Enzymes	04	02	04	02	08
4	Corrosion and its prevention	05	04	02	03	09
5	Water Hardness	04	04	02	02	08
6	Analytical Methods	04	02	02	02	06
7	Nuclear chemistry	05	02	02	02	06
8	Food Chemistry	07	04	02	-	06
9	Lubricants	03	03	02	-	05
10	Polymers	04	02	04	02	08
TOTAL		42	27	26	17	70

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy).

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

7. SUGGESTED LIST OF EXERCISES/PRACTICALS.

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list of exercises/practical/experiments for guidance.

Sr. No.	Unit No.	Practical Exercises (outcomes in Psychomotor Domain)	Teaching Hours
1	5	Determination of temporary and permanent hardness of water by EDTA method.	02
2	5	Estimation of chloride in water.	02
3	5	Estimation of dissolved oxygen in water.	02
4		To find the surface tension of a liquid by capillary rise method	02
5	5	Determination of COD in water sample.	02
6	5	Estimation of available chlorine in bleaching powder.	02
7	9	Determination of viscosity of oil.	02
8	5	Estimation of activity of water sample.	02
9	5	Estimation of alkalinity of water sample.	02
10	5	Determination of carbonate and non-carbonate hardness by soda reagent.	02
11	5	Determination of coagulation of water and chloride ion content.	02
12		Determination of specific rotation of an optically active compound.	02
		Total	24

Note : Minimum Ten Experiments/Practical Exercises should be performed by the students from the above given list. Or any other experiments related to above topics

8. SUGGESTED LIST OF STUDENT ACTIVITIES.

Following is the list of proposed student activities like:

- Teacher guided self learning activities.
- Course/topic based internet based assignments.
- Library survey regarding Engineering Material used in different industries.
- Industrial Visits of one or Two Industries.
- Quiz & Brain storming session related to Fuel properties & Utilization of fuel for different
- purposes.
- Sampling & Testing of water collected from different places.
- These could be individual or group-based

9. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr. No.	Title of Book	Author	Publication
1.	Engineering Chemistry	JAIN & JAIN	Dhanpat Rai and Sons
2	Engineering Chemistry	Sunita Ratan	S. K Katria and sons
3	Principles of Physical Chemistry	Puri and Sharma	Shoban Lal Nagin Chand

B. List of Major Equipment/ Instrument

- pH- Meter
- Red wood Viscometer.
- Glasswares

C. List of Software/Learning Websites

1. www.science.howstuffworks.com.
2. www.chemistryteaching.com