

**G.PULLAIAH COLLEGE OF ENGINEERING AND TECHNOLOGY:  
KURNOOL  
DEPARTMENT OF HUMANITIES AND SCIENCES**

**B. Tech I YEAR I SEMESTER  
COURSE DESCRIPTION**

<b>Course Code</b>	:	<b>15A51101</b>
<b>Course Title</b>	:	<b>ENGINEERING CHEMISTRY</b>
<b>Regulation</b>	:	<b>R15- JNTU A</b>
<b>Course Structure</b>	:	Lectures    Tutorials    Practicals    Credits
		3                   1                   -                   3
<b>Course Coordinator</b>	:	Dr. SYEDA JEELANI BASRI
<b>Team of Instructors</b>	:	M.Ravi

**I. Course Overview:**

The primary objective of an Engineering Chemistry course is to introduce the students to the concepts and applications of chemistry in Engineering. It should cultivate in them an ability to identify chemistry in each piece of finely engineered products used in households and industry. It aims to strengthen the fundamental concepts of chemistry and then builds an interface with their industrial applications. It deals with applied and industrially useful topics, such as Water Technology, Engineering materials, Electrode Potential and Cells, Fuels, Polymers and Corrosion. This course will involve minimum lecturing, content will be delivered through assigned reading and reinforced with large and small group discussions, as well as assigned in class (and occasional out of class) group activities. Water and its treatment for various purposes, engineering materials such as plastics, composites, ceramic, abrasives, their preparation, properties and applications, conventional and non-conventional energy sources, nuclear, solar, various batteries, combustion calculations, corrosion and control of metallic materials.

**II. Prerequisite(s):**

Level	Credits	Periods / Week	Prerequisites
UG	3	3	Thorough knowledge of Basic chemistry

**III. Marks Distribution:**

Subject	End Examination	Internal Examinations	Total Marks
Engineering Chemis	70 Marks	30 Marks	100 Marks

Internal Examination 30 marks  (80% of the best marks and 20% of least marks)	I mid term examination (1 hour 50 min)	I unit & II unit	Objective paper (20 min)	20 multiple answer questions, each question carrying ½ mark.
			Descriptive paper (90 min)	2 questions to be answered out of 4 question with internal choice
	II mid term examination (1 hour 50 min)	III unit IV unit & V unit	Objective paper (20 min)	20 multiple answer questions, each question carrying ½ mark.
			Descriptive paper (90 min)	2 questions to be answered out of 4 question with internal choice

#### IV. Evaluation Scheme:

S. No.	Component	Duration	Marks
1	I Mid Examination	1hr 50 mts	30
2	II Mid Examination	1hr 50 mts	30
3	External Examination	3	70

#### V. Course Objectives:

- 1) This course aims imparting intensive and extensive knowledge of the subject, so that the Student can understand the role of chemistry in the field of engineering.
- 2) This course is also aimed at developing analytical capabilities of the students so that they characterize, transform and use the materials in engineering; apply the knowledge gained in Solving related engineering problems.
- 3) To develop fascination towards engineering chemistry and scientific reasoning in students.

#### VI. Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. To explore the engineering application of polymeric materials
2. To understand the basic principle of polymers
3. To develop awareness about the usage of conducting polymers as an engineering material.
4. To justify the immense importance of basic constructional material, portland cement in civil engineering works.
5. To identify the electrolytic cell and electrochemical cells, with the different types of batteries

6. To access the quality and utility of suitable water for industrial as well as domestic applications.
7. To know the main factors affecting the rate of corrosion
8. To apply the corrosion control methods to prevent corrosion metals
9. To describe the combustion process of the fuels and the calorific values of the fuels.
10. To interpret the vitality of phase rule in metallurgy.
11. To summarize the application of phase rule to one and two component systems
12. To develop the knowledge of surface chemistry
13. To extrapolate the knowledge of cell, electrode, cathode, anode, electrolysis, electromotive force and reference electrode

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VII. How Course Outcomes are assessed:

Program Outcomes		Level	Proficiency assessed by
PO1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Exercises
PO2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Lab experiments
PO3	<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 the public health and safety, and the cultural, societal, and environmental considerations	N	Assignments, Tutorials
PO4	<b>Conduct investigations of complex problems:</b> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	N	---
PO5	<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.	S	Technical application
PO6	<b>The engineer and society:</b> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice	N	--
PO7	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	N	--
PO9	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	S	Seminars Discussions
PO10	<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	N	--

PO11	<b>Project management and finance:</b> Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Design Exercises, Seminars, Paper Presentations
PO12	<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	N	--
PO13	<b>Successful Career and Immediate Employment:</b> An ability to recognize the importance of professional developments by pursuing post graduate studies or facing competitive examinations that offer challenging and rewarding careers in designing.	S	Exams, Discussions

N = None

S = Supportive

H = Highly Related

#### VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	<b>Professional Skills:</b> The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity	S	
PSO2	<b>Problem-solving Skills:</b> The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	S	
PSO3	<b>Successful Career and Entrepreneurship:</b> The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies	S	

**IX. Syllabus:**

<b>UNIT – I</b>
<p><b>Water:</b> Sources of Water, Types of impurities in Water, Hardness of Water – Temporary and Permanent hardness. Units. Estimation of hardness by EDTA Method. Analysis of Water - Dissolved Oxygen. Disadvantages of Hard Water. Problems on hardness of water. Methods of Treatment of Water for Domestic Purpose – Sterilization: Chlorination, Ionization.</p> <p><b>Water for Industrial purpose</b> - Water for Steam Making, Boiler Troubles – Carry Over (Priming and Foaming), Boiler Corrosion, Scales and Sludge, Caustic Embrittlement. Water Treatment: - Internal Treatment – Colloidal, Phosphate, Calgon, Carbonate, Sodium aluminates. Conditioning of Water. External Treatment - Ion- Exchange Process; permutite process: Demineralization of Brackish Water – Reverse Osmosis.</p>
<b>UNIT – II</b>
<p><b>Polymers:</b> Polymerization Reactions – Basic concepts. Types of Polymerization – Addition(chain growth)and Condensation (step growth) Polymerization. Mechanism of polymerization: cationic, anionic, free radical and coordination covalent. Plastomers(rubber), Natural rubber , Compounding of rubber. Plastics –Thermosetting and Thermoplastics. Composition, Properties and Engineering Uses of the Following: Teflon, Bakelite, Nylon. Rubber – Processing of Natural Rubber and Compounding. Elastomers – Buna S, Buna N, Polyurethane Rubber; Polysulphide Rubber. Conducting Polymers- mechanism, Synthesis and applications of Polyacetylene and Poly aniline. Inorganic polymers-silicones, polyphosphazines and Engineering Applications</p>
<b>UNIT-III</b>
<p><b>Electro Chemistry:</b> Galvanic cells , Nernst equations, Numerical calculations. Batteries: Rechargeable batteries(lead acid, Ni-Cd, Lithium ion batteries).Fuel cells:(Hydrogen cell, methanol fuel cell and solide oxide fuel cells)</p> <p><b>Corrosion:</b> Introduction ,Types of corrosion- concentration cell, galvanic corrosion, chemical(dry ) Electrochemical (wet).Electrochemical theory of corrosion, Galvanic series, Factors affecting corrosion(Metal and environment). Prevention :Anodic and Cathodic Protection . Inhibitors(Anodic and cathodic).ElectroPlating(Copper, Nickel and Chromium),Electroless plating(Copper,Nickel)</p>
<b>UNIT-IV</b>
<p><b>Fuels and Combustion :</b> Definition and Classification of fuels, Characteristics of fuel, Calorific value- Units, Numerical problems. Solid Fuels: Coal- Classification and Analysis (Proximate and ultimate analysis), Metallurgical Coke – Characteristics &amp; Manufacture ( Otto-Hofmann). Liquid Fuels: Petroleum – Refining of petroleum, Gasoline- Octane number, Diesel- Cetane number, Synthetic Petrol: Bergius processes, Fischer Troph’s synthesis.Power alcohol: Manufacturing, Advantages and disadvantages of power alcohol. Gaseous fuel: Natural gas, Producer gas, Water gas, Coal gas and Biogas. Calorific Value &amp; its determination by Junker’s Gas Calorimeter). Combustion: Basic principle and numerical problems, Flue gas analysis by Orsat’s apparatus.</p>
<b>UNIT – V</b>
<p><b>Chemistry of Engineering Materials:</b> Cement: composition , Classification and preparation (dry and wet) , setting and Hardening of cement (reactions).<b>Refractories :</b> Introduction, Classification, properties and applications. <b>Lubricants :</b> Introduction, classification(Solid, liquid, semi solid, emulsion and synthesis) , Theories of Lubrication( Thin film, thick film and extreme pressure), properties of lubricants and application. Carbon clusters: Fullerenes and carbon nano tubes(CNT)</p>

## X. List of Text Books / References / Websites / Journals / Others

### Text Books:

1. Chemistry for Engineers Prof. K.N.Jayaveera, Dr.G.V.Subba Reddy and Dr.C. Ramachandraiah, McGraw Hill Higher Education Hyd., 2009
2. A text book of Engineering Chemistry by S.S. Dara, S.Chand & Co, New Delhi (2008)
3. Text book of Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company, 15th edition New Delhi (2008).

### Reference Books:

1. Engineering Chemistry Dr. K. B. Chandrasekhar, Dr. U.N. Dash, Dr. Sujatha Mishra, Scitech Publications(India) Pvt. Limited, Hyderabad. 2009
2. Fuel Cells principles and applications by B.Viswanath, M.Aulice Scibioh-Universities press
3. Chemistry of Engineering Materials by C.V. Agarwal, Tara Publication, Varanasi.2008
4. Physical Chemistry - Glasston & Lewis.
5. Engineering Chemistry (Vol.1&2) by J C Kuriacose and J. Rajaram, Tata McGraw-Hill Co, New Delhi (2004)
6. Applied Chemistry: A Text Book for chemistry for Engineers & Technologists, G.D. Gesser, Springer, 2000

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XI. Course Plan:

Lecture No.	Learning Objective	Topics to be covered	Reference
<b>UNIT-I</b>			
1-3	Able to learn about water types their treatment and their purification	Water-sources of water, types of impurities	<b>T1</b>
4-5	To able to learn about types of hardness	Hardness of water, temporary and permanent	<b>T1</b>
5-6	To calculate the hardness present in water ,their related different problems depending on different hardness	Units and problems of hardness	<b>T1,T3</b>
6-7	Able to understand structure of EDTA and analyses the presence of different hardness producing ions ,	Estimation of hardness of water by EDTA method	<b>T1,T3</b>
7-8	Able to understand the oxygen present in given sample by wrinkle's method	Analysis of water-dissolved oxygen, alkalinity , acidity analysis	<b>T3</b>
8-9	Able to analyses the effect of hardness and improve the quality water by domestic purpose	Disadvantages of hardness of water – methods of treatment of water for domestic purpose	<b>T1,T3</b>
9-10	To avoid the different troubles by using ion exchange or zeolite methods and external treatments	Boiler troubles, water treatment – internal and external, Demineralisation of brackish water	<b>T1</b>
<b>Unit-II</b>			
10-11	To know the polymerization mechanism and reaction	Polymers-definition and classification.	<b>T1</b>
11-12	Able to access the functionality ,homochain, heterochain polymers and tacticity	basic concepts	<b>T1,T3</b>
11-12	To study the mechanisms of polymerizatio, how does the condensation and coordination occur	Types of polymerization-addition and condensation and co-polymerization	<b>T1</b>
12-13	To have the over view knowledge of the plastics their synthesis and applications	Plastics-types of plastics	<b>T1</b>
12-13	To have the over view knowledge of the moulding plastics their synthesis and applications depending on the tempratures	Preparation, properties and uses of thermo plastics	<b>T1,T3</b>
13-14	To have the over view knowledge of the moulding and demoulding plastics their synthesis and applications depending on the tempratures	Preparation, properties and uses of thermo setting plastics	<b>T1,T3</b>
14-15	To know the knowledge of the synthesis of the rubber and	Natural rubbers -introduction, processing and compounding of rubber	<b>T1</b>



	commercialisation of rubber adding different additive and colouring of polymers ec..		
15-16	To know the synthesis of the elastomers their properties and applications	Elastomers- buna-s, buna-n ,polyurethane rubber and silicon rubber	<b>T1,T3</b>
16-17	Applications and synthesis of polymers with the studies on the delocalization on pi-electrons	Conducting polymers-synthesis and application of polyacetalene and poly aniline.	<b>T2,T3</b>
17-18	The knowledge of inorganic polymers,their existence with change in concentration and temperaters,applications can be known	Inorganic polymers- phosphazine, silicones preparation and properties	<b>T1</b>
<b>Unit-III</b>			
18-19	To have the knowledge about the Galvanic cell, Nernst equation application	Galvanic cell, Nernst equation derivation	
19-20	To have the knowledge about the electrochemical cell	Electrochemical cells-measurement on EMF	<b>T1</b>
20-21	To know the knowledge about the EMF and find the potentials depending on reduction and oxidation	Standard electrode potential	<b>T3</b>
21-22	To know the knowledge about the concentration of cells depending on the tranference	Concentration cells-with transference, without transference	<b>T3</b>
22-23	Able to understand the types of batteries and their working and uses	Batteries-types, Primary batteries, working of batteries	<b>T1,T3</b>
24	Able to understand the types of fuel cells and their working and uses	Fuel cells-types and working of Methanol fuel cell, Hydrogen oxygen fuel cell.	<b>T1</b>
24-25	Able to understand the types of prevention and their working and uses	Applications , technical uses of batteries	<b>T1</b>
25-26	<i>Able to understand how the definition of corrosion, and characteristics</i>	Science of corrosion, definition and introduction	<b>T1</b>
28	<i>Able to understand how the metal undergoes corrosion-examples</i>	Galvanic corrosion, Concentration cell corrosion	<b>T1,T2</b>
28-29	Able to understand corrosive areas depending on the types of medium	Types of corrosion-dry, wet corrosion	<b>T1,T3</b>
29-30	Able to understand different types of corrosion depending on the concentrations and conditions	Theories and mechanisms of corrosion	<b>T1,T2</b>
30-31	To know the knowledge about the type of series depending the anodic nature and electrode potential	Galvanic series –galvanic corrosion	<b>T1,T3</b>
31-33	To analysis t he percentage of corrosion depending the concentration of solutions	Concentration cell corrosion	<b>T3</b>
34-36	To know the knowledge about the factors which influence corrosion	Factors influencing corrosion	<b>T1</b>

37-38	To know the various methods to inhibit the corrosion	Controlling methods of corrosion	<b>T3</b>
39-40	To use different types of inhibitors and their applications	Inhibitors-their uses	<b>T1</b>
41-43	To have the knowledge of electroplating with different electrolytic medium	Electroplating with copper, nickel and chromium	
44-46	To have the knowledge of electrolessplating in the absence of electrolytic medium	Electrolessplating with copper and nickel	
<b>Unit- IV</b>			
47-49	To have the through knowledge about the combustion ,examples related to the process of combustion	Fuels and combustion-defination and classification	<b>T1</b>
50-53	Able to characterize the types of fuel and to check the efficiency of the fuel depending on the viscosity index and lubrication,fire and flash point ,cloud and pour point etc...	Characteristics of a good fuel, Types of fuels	<b>T1</b>
54-57	To study the properties of metullargical coke ,otta hoffman's synthesis of coke etc..	Metallurgical coke-characteristics and manufacture	<b>T1,T3</b>
58-63	To have the through knowledge about the synthesis of petrol,industrially	Petroleum-refining –synthetic petrol-Bergius and Fischer Troph's process	<b>T1,T3</b>
64-66	To know the units of the fuel,calculation in terms of calories,units,and ananalysis of the fuel by junker's gas method and bomb calorimeter	Calorific value and its determination-Junker's gas and Numerical problems	<b>T1,T3</b>
67-70	Helps to know the combustion process and analysis of fule gas by orsat's apparatus and to solves related problems	Combustion-flue gas analysis by orsat's method and problems.	<b>T1</b>
<b>Unit-V</b>			
71-72	Able to know the different types of building materials,their applications	Building materials-introduction	<b>T1</b>
73-74	Able to know about the composition of cement ,proportion of contents added ,for hardening, setting	Cement-Types, composition of Portland cement-analysis, setting and hardening of cement.	<b>T1</b>
75-77	Able to know what exactly is the refinery, their properties, proportion of preparation and uses in the technical field.	Refractories- definition- classification , properties and applications	<b>T1,T3</b>
78-81	To know the knowledge of the lubricants ,their types ,their viscous nature and viscosity index, and their uses	Lubricants-principles,classification, Properties,theories	<b>T1</b>
82-84	To know the knowledge of the Carbon clusters,their types ,Carbon nanotubes, Fullerenes	Carbon clusters- Fullerenes and carbon nanotubes	<b>T1,T3</b>

**Prepared By**  
**Date**

**:T.SYEDA JEELANI BASRI**  
**: 8<sup>TH</sup> JAN 2016**

HOD, H&S

**ACCEPT**