Pandit Deendayal Energy University **School of Energy Technology**

20CH101T					Engineering Chemistry					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To provide the knowledge about structural features, synthesis, properties of various categories of materials.
- To develop the fundamental understanding about surface chemistry, kinetics and catalysis.
- To develop the skills for phase, microstructural and elemental characterization of materials.
- To provide the knowledge about the role of chemistry in modern engineering applications.

UNIT 1: Chemistry of Engineering Materials **10 h**

Traditional Materials: Introduction and classification of materials; metallic materials, polymeric, ceramic materials
Advanced Materials: Introduction to nanomaterials: Properties and application; Carbonaceous materials (fullerene, carbon nanotube, graphene, etc.); Composite materials; Liquid crystals: Classification and Application

UNIT 2: Modern Analytical Techniques **12h**

Instrumentation, principle and characterization of materials: X-ray diffraction (XRD), Electro-analytical Techniques (pH-metry, conductometry, potentiometry); FTIR, UV-visible spectroscopy; Thermal analysis (TGA-DTA-DSC, DMA); Chromatographic techniques (GC, HPLC)

UNIT 3: Surface Chemistry, Kinetics & Catalysis **12h**

Adsorption - Characteristics, Classification, Application , Adsorption isotherms- Freundlich, Langmuir & BET
Chemical Kinetics - Rate law, Arrhenius equation, Transition state theory, Collision theory; Complex reactions
Catalysis - Homogeneous and Heterogeneous Catalysis; Mechanism of Catalysis; Industrial Applications of catalysts

UNIT 4: Chemistry of Energy Devices **10 h**

Principles and applications of Batteries, Fuel Cells and Supercapacitors; Photocatalytic hydrogen production; Traditional and new generation solar cells

Max. 44 h

COURSE OUTCOMES

On completion of the course, student will be able to
CO1- Acquire knowledge about metallic, polymeric and ceramic crystal structure.
CO2 - Understand the fundamental concept about surface chemistry, catalysis and kinetics.
CO3 - Acquire knowledge about structural features, properties of different classes of materials including nanomaterials.
CO4 - Explain the methodologies for the synthesis of different categories of materials.
CO5 - Develop the skill for phase, microstructural and elemental characterisation of materials.
CO6 - Develop the knowledge on the role of chemistry in various modern engineering applications.

TEXT/REFERENCE BOOKS

1. An Introduction to Materials Science & Engineering, W.D. Callister, John Wiley & Sons (2007).
2. Fundamental of Ceramics, MW Barsoum, IOP publishing (2003).
3. Text book of Nanoscience and Nanotechnology, T. Pradeep, Mc. Graw Hill Education (2003).
4. Textbook of Nanoscience and Nanotechnology, Murty, Shankar, B Raj, Rath, Murday, Springer (2013).
5. Materials Science and Engineering, V. Raghavan, Prentice-Hall of India Private Limited (2003).
6. Principles of Instrumental Analysis, Douglas A. Skoog, Donald M.West, 6th Edition, Cengage (2014)

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 h**
Part A/Question: 3 Questions from each unit, each carrying 3 marks	36 Marks
Part B/Question: 2 Questions from each unit, each carrying 8 marks	64 Marks

20CH101P					Engineering Chemistry					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

COURSE OBJECTIVES

- To enhance and develop scientific and analytical skills
- To relate concepts learned in chemistry and engineering to the real-world situations.
- To acquire skills to perform laboratory experiments.
- To demonstrate safe and proper use of standard chemistry glassware and equipment.

LIST OF EXPERIMENTS

1. **Iodometry**– To determine the strength of given copper sulphate solution by titrating against N/20 sodium thiosulphate (hypo) solution
2. **Iodimetry**– To determine the strength of given ascorbic acid by titrating against standard N/10 iodine solution
3. **Complexometric Titration**– To determine the total, permanent and temporary hardness of given water by complexometric titration using standard 0.01M EDTA solution
4. **pH metric titration**– To determine the strength of given HCl solution using a standard NaOH solution by performing a pH-metric titration
5. **Conductometric titration**– To determine the strength of given HCl solution using a standard NaOH solution by performing a conductometric titration
6. **Chemical Kinetics**– To study the kinetics of decomposition of sodium thiosulphate by a mineral acid
7. **Drawing chemical structures -** To Draw Chemical Structures of organic molecules using ChemDraw
8. **Colorimetric determination:** To determine the concentration of copper present in the effluent of electroplating industries by using colorimeter.
9. **Detection of biomolecule:** Detection of the presence of carbohydrates in test solution by using Benedict's reagent
10. **Preparation of drug molecule:** Preparation of Aspirin from salicylic acid
11. **Polymerization**– To prepare a polymer (Nylon 6,10), identify the functional groups by FT-IR

Max. <28> Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Apply the concepts learned in chemistry and design the molecules for different applications

CO2 - Enhanced ability to identify, analyze and interpret the results from the experiments

CO3- Carry out quantitative analysis by an instrumental method using Conductometer and pH meter.

CO4- Synthesis and analysis of compounds by titrimetric and instrumental techniques

CO5- Determine the concentration of unknown solutions by Spectrophotometric method. CO6- Investigate the reaction rate and predict the order and rate constant

TEXT/REFERENCE BOOKS

1. College Practical Chemistry, VK Ahluwalia, S Dhingra, A Gulati, Universities Press
2. Foundations of Experimental Chemistry, JB Baruah, P Gogoi, PharmaMed Press.
3. A Text Book of Chemistry Practical Vol I & II, SS Sawhney, M S Jassal, SP Mittal, APH Publishing Corp.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3Hrs**

Part A : Lab Work – Continuous Assessment 50 Marks

Part B : Lab Exam and Viva 50 Marks