KU3DSCCHE211: PROPERTIES OF MATTER AND ELECTROCHEMISTRY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC	200	KU3DSCCHE211	4	75

Learning Approach (Hours/ Week)		Marks Distribution			Duration of ESE (Hours)
Lecture/Tutorial	Practical/ Internship	CE	ESE	Total	
3	2	35	65	100	2

Course Description: This discipline specific course comprises of five modules out of which the first four modules describe the solid state and gaseous state properties of matter and electro chemistry concepts, and the fifth one provides knowledge regarding the methods of qualitative analysis.

Course Prerequisite: Should be aware of characteristic properties of matter and the basics of interaction of matter with light. Should have basic idea regarding - current, resistance and potential and reactions of various cations**.**

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Comprehensive understanding of properties of matter in the gaseous state and crystalline state	U
2	Understand the principles of spectroscopic analysis.	U
3	Apply the theoretical concepts in applications related to electrochemistry and electromotive force.	A
4	Understand the significance of nanomaterials.	U
5	Acquire skills in conducting qualitative analysis of cation mixtures.	An
6	Employ the techniques of nano material synthesis in practice.	An

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	3	0	0	0	0	0	0
CO 2	0	3	0	0	0	0	0
CO 3	0	0	3	0	0	0	0
CO 4	0	0	0	3	0	0	1
CO 5	0	0	0	0	3	1	0
CO 6	0	0	0	0	0	3	2

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**GASEOUS STATE**	**9**
	1	Gaseous State: Introduction - Kinetic molecular model of gases	
	2	Maxwell distribution of velocities and its use in calculating molecular velocities – Average velocity, RMS velocity and most probable velocity (derivations not required)	
	3	Collision number and collision frequency, mean free path	
	4	Boyle's law – Charles's law – Ideal gas equation	
	5	Behaviour of real gases –Deviation from ideal behaviour - Van der Waals equation (derivation not required).	
	6	Joule-Thomson effect and Liquefaction of gases.	
2		**CRYSTALLINE STATE AND SPECTROSCOPY**	**18**
	1	Solids – crystalline and amorphous solids – space lattice and unit cell	
	2	Crystal planes-laws of crystallography – Weiss indices and Miller indices. Bravais lattice – Bravais lattices of cubic crystals – characteristic planes in these lattices - interplanar distance ratio	
	3	X-ray analysis of crystals – Bragg's equation – problems-Crystal structure of NaCl	
	4	Liquid crystals – types, properties and application	
	5	Spectroscopy**:** Electromagnetic spectrum- Ranges of different radiation-general features of spectroscopy.	
	6	Types of spectra – Rotational, vibrational and electronic spectra	

	7	Rotational spectra - Moment of inertia, rotational constant and bond length	
	8	Vibrational spectra – stretching and bending modes-Force Constant-Zero-point energy	
	9	Raman spectra – Stokes and Anti Stokes Lines	
	10	NMR spectra-chemical shift and spin-spin splitting	
3	**ELECTROCHEMISTRY AND ELECTROMOTIVE FORCE**		**12**
	1	Specific conductance – molar conductance and equivalent conductance – variation with dilution. - Ohm's law - Conductors - metallic and ionic conductors	
	2	Electrolysis – laws of electrolysis	
	3	Electrolytic conduction - Migration of ions – relative speed of ions – Transport number	
	4	Kohlrausch's law and applications. Conductometric titrations – advantages	
	5	Electro chemical cell – Daniel cell – Cell reaction – Single electrode potential – statement –explanation of Nernst equation	
	6	Standard hydrogen electrode – Calomel electrode –measurement of EMF-determination of pH using Hydrogen electrode	
	7	Potentiometric titration– concentration cells.	
4	**NANO CHEMISTRY**		**6**
	1	Evolution of Nano science – Historical aspects – preparations containing nano gold in traditional medicine, Lycurgus cup – Faraday's divided metal etc. Nano systems in nature.	
	2	Preparation of Nano particles – Top – down approach and bottom – up approach, sol – gel synthesis, colloidal precipitations, Co-precipitation, combustion technique.	

	3	Properties of nano particles: optical, magnetic and mechanical properties.	

	TEACHER SPECIFIC MODULE- PRACTICALS QUALITATIVE INORGANIC MIXTURE ANALYSIS	**30**
	Total 7 experiments to be done. A minimum of six cation mixtures are to be analysed and recorded. One experiment on nano synthesis is open-ended and is subjected to teacher's choice.	
5	**a. Reactions of cations**: Study of the reactions of the following cations with a view of their identification and confirmation. Lead, Copper, Iron, Aluminium, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Magnesium and Ammonium.	
	b.Cation analysis: Systematic qualitative analysis of a solution containing any two of the cations given in by semi micro methods.	
	Open ended Synthesis of Nanomaterials (suggestion) Synthesis of metal or metal oxide nano particles by sol gel method or some other method of teacher's choice may be carried out.	

Essential Readings:

1. P. W. Atkins and Julio de Paula, "Physical Chemistry," Oxford University Press
2. Physical Chemistry: Puri, Sharma and Pathania, Vishal Publishing Co.
3. A Textbook of Physical Chemistry: A S Negi and S C Anand, New Age International Publishers.
4. A Textbook of Physical chemistry: K. L. Kapoor, Volumes 2 &3, Macmillan India Ltd
5. Textbook of Physical Chemistry: Samuel Glasstone, McMillan Press
6. D A Skoog, D M West and S R Crouch, *Fundamentals of Analytical Chemistry,* 8th Edition, Brooks/Cole Nelson (Chapter 12-17).

7. Vogel's *Textbook of Qualitative Analysis*
8. G D Christian, *Analytical Chemistry,* John Wiley and Sons.
9. Solid state chemistry and its applications-Antony. R. West
10. Solid state chemistry by Lesley E. Smart and Elaine A. Morre
11. Introduction to solids Leonid V Azaroff
12. T. Pradeep, Nano: The Essentials, Mc Graw Hill Publishing Company, New Delhi (2007).
13. C. N. R. Rao and A.Govindraj, Nanotubes and Nanowires, Royal Society of Chemistry (2005).
14. V. S. Muraleedharan and A. Subramania, Nanosciece and nanotechnology, Ane Books Pvt. Ltd. New Delhi, 2009.

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation (ESE)		**65 (50T+15P)**
Continuous Evaluation (CCA)		**35 (25T+10P)**
Theory		**25**
a)	Test Paper*	10
b)	Assignment	5
c)	Viva-Voce	5
d)	Seminar	5
Practical10		
a)	Skill	4
b)	Record	4
c)	Punctuality	2
Total		**100**

*Average of best two test papers

Employability for the Course: The course enhances employability of the students by equipping them with essential knowledge and practical skills in chemistr