KU1DSCCHE114: BASIC CONCEPTS IN THEORETICAL AND ENVIRONMENTAL CHEMISTRY-I

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC	100	KU1DSCCHE114	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 course deals with the fundamental principles of chemistry. The topics covered include atomic structure, chemical bonding, Environmental chemistry, analytical techniques, and quantitative analysis.

Course Prerequisite: Elementary knowledge in PUC level Chemistry

Course Outcomes:

MODULE	UNIT	DESCRIPTION	HOURS
1	**ATOMIC STRUCTURE**		**10**
	1	Bohr atom Model (No derivation) – Atomic Spectra of Hydrogen – limitations – wave mechanical concept of atom	
	2	Heisenberg's Uncertainty Principle – Dual nature of electrons – de Broglie equation – quantum numbers. Orbit and orbitals.	
	3	The periodic table – periods and groups-s, p, d and f block elements – modern concept	
	4	Periodic trends – atomic radii, ionic radii & covalent radii – effective nuclear charge and screening effect	
		Ionization potential – electro negativity and electron gain enthalpy.	

2	**CHEMICAL BONDING**		**10**
	1	Types of chemical bonds-Ionic, covalent and co-ordinate bonds. Lattice energy of ionic compounds	
	2	VSEPR theory and its applications. Shape of molecules CO_2, BeF_2, BF_3, CH_4, NH_3, H_2O, NH_4^+, PCl_5, SF_6, ClF_3.	
	3	Orbital overlapping – Hybridization sp, sp^2, sp^3, sp^3d, sp^3d^2, d^2sp^3 and dsp^2 hybridization Shapes of organic molecules like methane, ethane, ethylene and acetylene.	

	4	V.B Theory-Explain with examples H_2, N_2, CH_4, $CH_2=CH_2$	
	5	MO theory. Formation of B_2, C_2, N_2 and O_2 molecules	
	6	Hydrogen bonding, types of hydrogen bonding – examples	

3	**ENVIRONMENTAL CHEMISTRY**		**10**
	1	Introduction-environment and segments- Pollutants of water : sewage, industrial effluents, soap and detergents, pesticides, fertilizers, heavy metals-biological magnification bioaccumulation	
	2	Toxic effect of pollutants, Water quality parameters – DO, BOD and COD, Water purification- sedimentation, coagulation, filtration, disinfection, ion exchange, desalination,	
	3	Air pollution – major regions of atmosphere, pollution by oxides of N, S, C, hydrocarbons and other organic chemicals, automobile exhausts, their physiological effects on vegetation and living organisms	
	4	Ozone layer – importance – depletion of ozone – consequences,	
	5	Greenhouse effect – global warming – acid rain, Toxicity and environmental hazards of pesticides, Radiation pollution and noise pollution	
4	**ANALYTICAL CHEMISTRY AND GOOD LABORATORY PRACTICES**		**10**
	1	Accuracy and precision. Errors-classification. Concept of molarity, Normality, Molality (numerical problems expected).	
		Principle of volumetric analysis – Acidimetry and alkalimetry. Theory of acid-base indicators.	

	2	Types of analytical methods –Qualitative and Quantitative analysis Inorganic Qualitative analysis	
	3	**Good Laboratory Practices**	**5**
		a) Safe laboratory practices and Lab safety signs; Personal protective equipment (PPE) in Chemical laboratory, Awareness of Material Safety Data Sheet (MSDS).	
		b) Hazardous Symbols and Signs (Physical, Chemical, Environmental and Health), Lab accidents and safety measures	
		c) Simple first aids: Electric shocks, fire accidents, burn by chemicals, cut by glass and inhalation of poisonous gases.	
	TEACHER SPECIFIC MODULE- - PRACTICALS QUANTITATIVE ANALYSIS I		**30**
5	*A minimum of eight experiments to be conducted Two burette method (As per Green Chemistry Protocol) may be preferred for the titrations. Out of eight experiments one virtual lab experiment is open-ended and is subjected to teacher's choice.		
	1)Preparation of standard solutions (minimum 2) 2)Dilute solutions from Stock solutions in lab (minimum 2)		
	3)Acidimetry and Alkalimetry (minimum 3) a) Estimation of NaOH/KOH using standard Na_2CO_3. b) Estimation of $HCl/H_2SO_4/HNO_3$ using standard oxalic acid.		
	5. Use of Online Educational Resources (OER's) like Phet.Colarado.edu as a learning tool for "Build a molecule", "Chemical Bonding" and "Virtual titration tool"		

Essential Readings:

1. B R Puri, L R Sharma, K C Kalia, Principles of Inorganic Chemistry, Milestone