University of Kerala

Discipline	CHEMISTRY				
Course Code	**UK2DSCCHE101**				
Course Title	**FUNDAMENTALS OF CHEMISTRY II**				
Type of Course	**DSC**				
Semester	2				
Academic Level	100 - 199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2 hours	5
Pre-requisites	1. Higher secondary level science knowledge 2. Any first semester DSC (Chemistry) offered by UoK (preferable)				
Course Summary	The course includes subjects in petrochemicals, catalysis, photochemistry, metallurgy, and nanomaterials and basic principles in the gaseous state. Students have practical experience in analytical procedures and acquire critical thinking skills through open-ended experiments such as gravimetric analysis and determination of physical constants, focused on inorganic qualitative analysis.				

Detailed Syllabus:

Module	Unit	Contents	Hrs
	FUNDAMENTALS OF CHEMISTRY II		**75**
I	**GASEOUS STATE**		**9**
	1	Maxwell's distribution of molecular velocities (derivation not expected), average, most probable and rms velocities (derivations not expected, simple problems expected)	3
	2	Collision number and collision frequency, mean free path,	1
	3	Deviation of gases from ideal behaviour – Boyle temperature, derivation of Van der Waal's constants and critical constants	2
	4	Law of corresponding states – reduced equation of state, Joule Thomson effect, liquefaction of gases – Linde's and Claude's processes.	3
II	**PETROCHEMICALS AND ALTERNATE SOURCES**		**9**
	5	Petrochemicals: - Introduction, Natural gas - CNG, LNG and LPG. Coal: classification based on carbon content- Carbonisation of coal.	2
	6	Crude oil: constitution and distillation, composition and uses of important Fractions Ignition point, flash point and octane number-cracking Usage and depletion of petroleum products.	3

	7	Need for alternative fuel and Green Chemistry approaches for sustainable development.	1
	8	Introduction, Solar energy harvesting- photosynthesis Photo voltaic cell, conventional solar cells, nano structured solar cells, Hydrogen as the future fuel	3
III	**CRYSTALLINE STATE**		**9**
	9	Isotropy and anisotropy – symmetry elements in crystals – the seven crystal systems. Miller indices, Bravais lattices, primitive, bcc and hcc of cubic crystals	3
	10	Representation of lattice planes of simple cubic crystal - Density from cubic lattice dimension – calculation of Avogadro number	2
	11	Bragg equation, diffraction of X-rays by crystals – single crystal and powder method. Detailed study of structures of NaCI and KCl crystals.	4
IV	**METALLURGY & CHEMISTRY OF NANOMATERIALS**		**18**
	12	General principles of occurrence and extraction of metals, Concentration of ores- roasting, calcination and smelting	3
	13	General Methods of extracting metal from concentrated ore, examples Electro metallurgy-Metallurgy of Aluminium, Sodium-Pyrometallurgy	3
	14	Refining of crude metals: Distillation, Liquation, electrolytic and zone refining and vapour phase refining (Mond's process and Van Arkel process) Metallurgy of titanium, nickel, thorium and uranium	3
	15	Evolution of Nano science – Historical aspects – preparations containing nano gold in traditional medicine, Lycurgus cup – Faraday's divided metal etc. Nanosystems in nature.	2
	16	Preparation of Nano particles – Top – down approach and bottom – top approach, Sol – gel synthesis and colloidal precipitations.	3
	17	Properties of nano particles: optical, magnetic and mechanical properties.	2
	18	Applications of nano materials in electronics, sensors and medical applications (use Au, Ag, ZnO and ZnO_2 as examples)	2
V	**PRACTICALS: INORGANIC QUALITATIVE ANALYSIS**		**30**
	19	**I. REACTIONS OF THE FOLLOWING CATIONS:** Hg^{+}, Pb^{2+}, Ag^{+}, $Hg^{2+,}$ Bi^{3+}, Cd^{2+}, As^{3+}, Sb^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Ca^{2+}, Sr^{2+}, Mg^{2+} and NH_4^{+}. **II. SYSTEMATIC ANALYSIS OF TWO CATIONS IN A MIXTURE** The cations must be provided in solutions. A student must analyze **at least 5 mixtures** containing two cations each.	15
	20	**OPEN ENDED PRACTICALS: (Any 3 experiments are to be conducted - May be selected from the list or the teacher can add related experiments)** **III. GRAVIMETRIC ANALYSIS** a. Estimation of water of hydration in barium chloride crystals.	15

		b. Estimation of barium chloride solution. **IV. DETERMINATION PHYSICAL CONSTANTS** a. Determination of boiling points of common solvents (b.pt range 100°C - 130°C b. Determination of melting points of organic substances (m.pt range 100°C - 130°C)	

References

1. B. R. Puri, L. R. Sharma and M. S. Pathania, *Principles of Physical Chemistry*, 46th Edn. Vishal Publishing Co. New Delhi.
2. J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K Medhi, *Inorganic Chemistry*, 4th Edn. Pearson.
3. F. A. Cotton and Wilkinson, *Advanced Inorganic Chemistry*, John Wiley, New York.
4. P. L. Soni, O. P. Dharmarsha, U N Dash, *Textbook of Physical Chemistry*, 23rd Edn., Sultan Chand & Sons, New Delhi, 2011.
5. Gurudeep Raj, *Advanced physical chemistry*.
6. F Daniel and R. A. Alberty, *Physical chemistry*.
7. T. Pradeep, *A Text book of Nanoscience and Nanotechnology*, Mc Graw Hill, New Delhi.
8. J. V. V..Ramanujam, "*Semi micro Qualitative Analysis*"
9. E. S. Gilreath "*Qualitative Analysis using semi micro method*" Mc Graw Hill.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Analyze the behavior of gases, the concepts of collision dynamics, deviations from ideal behavior, and the principles underlying gas liquefaction processes.	An	PSO-1
CO 2	Get the idea about the composition, properties, and processing of petrochemical resources, their environmental impact and explore sustainable alternatives for development.	An, C	PSO-2
CO 3	Analyze crystal symmetry, lattice structures, and X-ray diffraction techniques and detailed structures of crystalline solids such as NaCl and KCl.	Ap, An	PSO-3
CO 4	Analyze the principles and methods involved in the extraction, refining, and application of metals and the basic ideas of nanoscience, the synthesis, properties, and applications of nanomaterials in various fields.	An, E	PSO -3
CO 5	Apply the basic principles in qualitative analysis and identify	Ap, An	PSO-2 &4

	cation and anion.		

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: FUNDAMENTALS OF CHEMISTRY II

Credits: 3:0:1 (Lecture:Tutorial:Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	CO-1	PO-1 PSO-1	An	F, C	T	
2	CO 2	PO-2 PSO-2	An, C	P	T	
3	CO 3	PO-8 PSO-3	Ap, An	C	T	
4	CO 4	PO-3 PSO-3	An, E	C, M	T	
5	CO 5	PO-6 PSO-2 &4	Ap, An	P		P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO 2	-	2	-	-	-	-	2	-	-	-	-	-	-
CO 3	-	-	3	-	-	-	-	3	-	-	-	-	-
CO 4	-	-	3	-	-	-	-	3	-	-	-	-	-
CO 5	-	2	-	2	-	-	-	-	-	-	2	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√	√		√
CO 2	√	√		√
CO 3	√	√		√
CO 4	√			√
CO 5	√			√