



## 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
		<b>FUNDAMENTALS OF CHEMISTRY II</b>	<b>75</b>
<b>I</b>	<b>GASEOUS STATE</b>		<b>9</b>
	1	Maxwell's distribution of molecular velocities (No derivation), average, most probable and rms velocities	3
	2	Collision number and collision frequency, mean free path,	1
	3	Deviation of gases from ideal behaviour – Boyle temperature, derivation of vander waals 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
<b>II</b>	<b>PETROCHEMICALS AND ALTERNATE SOURCES</b>		<b>9</b>
	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
<b>III</b>	<b>CRYSTALLINE STATE</b>		<b>9</b>
	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 NaCl and KCl crystals.	4
<b>IV</b>	<b>METALLURGY &amp; CHEMISTRY OF NANOMATERIALS</b>		<b>18</b>
	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 Chromatographic techniques and vapour phase refining (Mond's process and Van Arkel process) Metallurgy of titanium, cobalt, 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, colloidal precipitations, Co-precipitation, combustion technique.	3
	17	Properties of nano particles: optical, magnetic and mechanical properties.	2
	18	Applications of nano materials in electronics, robotics, computers, sensors, mobile electronic devices, medical applications (use Au, Ag, ZnO and ZnO <sub>2</sub> as examples)	2
	<b>V</b>	<b>PRACTICALS: INORGANIC QUALITATIVE ANALYSIS</b>	
19		<b>I. REACTIONS OF THE FOLLOWING CATIONS:</b> Hg <sup>+</sup> , Pb <sup>2+</sup> , Ag <sup>+</sup> , Hg <sup>2+</sup> , Bi <sup>3+</sup> , Cd <sup>2+</sup> , As <sup>3+</sup> , Sb <sup>3+</sup> , Sn <sup>2+</sup> , Sn <sup>4+</sup> , Fe <sup>3+</sup> , Al <sup>3+</sup> , Cr <sup>3+</sup> , Mn <sup>2+</sup> , Zn <sup>2+</sup> , Ni <sup>2+</sup> , Cd <sup>2+</sup> , Ba <sup>2+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> , Mg <sup>2+</sup> and NH <sub>4</sub> <sup>+</sup> .  <b>II. SYSTEMATIC ANALYSIS OF TWO CATIONS IN A MIXTURE</b> The cations must be provided in solutions. A student must analyze <b>at least 8 mixtures</b> containing two cations each.	15
20		<b>OPEN ENDED PRACTICALS: (Any 3 experiments are to be conducted - May be selected from the list or the teacher can add related experiments)</b>  <b>III. GRAVIMETRIC ANALYSIS</b> a. Estimation of water of hydration in barium chloride crystals.	15

		b. Estimation of barium chloride solution. <b>IV. DETERMINATION PHYSICAL CONSTANTS</b> 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)	
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### 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*, 23<sup>rd</sup> 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	Understand the effect of temperature on molecular velocities of gases and equation for real gases	U	PSO-1
CO 2	Apply the principles in liquefaction of gases	Ap	PSO-2
CO 3	Apply the importance of energy and environment conservation	Ap	PSO-3
CO 4	Get insight to the emerging area of nano and advanced materials	U	PSO-3
CO 5	Apply the principles of physical Chemistry in Catalysis and photochemistry	Ap	PSO-4
CO 6	Apply the basic principles in qualitative analysis and identify cation and anion.	Ap	PSO-2 &4
CO 7	Discuss the basic principles of metallurgy	U	PSO-1 &2
CO 8	Demonstrate the extraction of some metals used in daily life	Ap	PSO-2&4

CO 9	Apply the principles in analytical chemistry to identify the cations	Ap	PSO-5
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**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	U	F, C	T	
2	CO 2	PO-2 PSO-2	Ap	P	T	
3	CO 3	PO-8 PSO-3	Ap	C	T	
4	CO 4	PO-3 PSO-3	U	C, M	T	
5	CO 5	PO-2 PSO-4	Ap	C	T	
6	CO 6	PO-6 PSO-2 &4	Ap	P		P
7	CO 7	PO-2& 6 PSO-1 &2	U	P		P
8	CO 8	PO-2 PSO-2&4	Ap	P		P
9	CO 9	PO-3 PSO-5	Ap	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	-	-	-	3	-	-	3	-	-	-	-	-	-
CO 6	-	2	-	2	-	-	-	-	-	-	2	-	-
CO 7	2	2	-	-	-	-	2	-	-	-	2	-	-
CO 8	-	2	-	2	-	-	2	-	-	-	-	-	-
CO 9	-	-	-	-	3	-	-	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	√			√
CO 6	√			√
CO 7			√	
CO 8			√	
CO 9	√			√