

University of Kerala

Discipline	CHEMISTRY							
Course Code	UK3DSCCHE202							
Course Title	CHEMICAL INSIGHTS: FROM SOIL TO							
	PETROCHEM	ICALS						
Type of Course	DSC							
Semester	3							
Academic Level	200 - 299							
Course Details	Credit	Lecture	Tutorial	Practical	Total			
		per week	per week	per week	Hours/Week			
	4	3 hours	-	2 hours	5			
Pre-requisites	4. Higher second	dary level sc	ience knowle	edge				
	5. First & secon	d semester D	SCs (chemis	stry) offered b	y UoK			
	(preferable)							
Course Summary	This course co	vers soil a	nd water ch	nemistry, elec	ctrochemistry,			
	petrochemicals, instrumental methods of analysis, and practical							
	physical chemistry experiments. Students gain insights into the							
	chemical processes governing soil and water behaviour, industrial							
	applications of e	electrochemi	stry and pet	rochemicals,	and hands-on			
	experience in various analytical techniques.							

Detailed Syllabus:

Module	Unit	Content	Hrs
	C	HEMICAL INSIGHTS: FROM SOIL TO PETROCHEMICALS	75
Ι	SOIL	AND WATER CHEMISTRY	18
	1	Soil – Composition, mineral matter in soil process of soil formation,	5
		weathering – physical (mention), chemical (detail) + biological	
		(mention) Saline and alkaline soil (brief explanation) Rocks - different	
		types (Igneous, sedimentary and Metamorphic)	
	2	Analysis of lime stone (qualitative treatment only)	1
	3	Chemistry of salt-affected soils and amendments, soil pH, ECe, ESP,	3
		SAR and important relation	
	4	Soil management and amendments. Chemistry and electrochemistry of	2
		submerged soils	
	5	Water Analysis Water quality parameters COD, BOD, main quality	3
		characteristics of water (alkalinity, hardness, total solids and oxidation)	
	6	Water treatment including chemical (Precipitation, aeration,	4
		osonisation, chlorination) and physical methods of sterilization.	
II	ELEC	CTRO CHEMISTRY	9

	7	Transport number – definition, determination by Hittorffs method and	2
		moving boundary method, application of conductance measurements	
	8	Conductometric titrations involving strong acid – strong base, strong	2
		acid – weak base, weak acid – strong base and weak acid – weak base	
	9	EMF – Galvanic cells, measurement of emf, cell and electrode	1
	-	potential, IUPAC sign convention. Reference electrodes. SHE and	_
		calomel electrode	
	10	Standard electrode potential. Nernst equation, anion and cation	2
	_	reversible electrodes, redox electrode with examples, quinhydrone	$\langle \mathcal{P} \rangle$
		electrode, glass electrode	
	11	Concentration cell without transference. Potentiometric titration Fuel	2
		cells $-H_2 - O_2$ and hydrocarbon $-O_2$ type	
III	PETI	RO CHEMICALS	9
	12	Introduction to crude oil, exploratory methods, constitution of crude	2
		oil. natural gas – constituents	
	13	Distillation of crude oil, separation of natural gas and different	2
		fractions Meaning of terms such as ignition point, flash point, octane	
		number	
	14	Types of hydrocarbon fuels and their characteristics	2
	15	Cracking – catalytic cracking, hydro cracking, isomerization,	3
		reforming, sulphur, hydrogen, petroleum, coke and nitrogen	
		compounds from petroleum	
IV	INST	RUMENTAL METHODS OF ANALYSIS	9
	16	Spectral methods – Atomic Absorption Spectroscopy (AAS) principle,	2
		measurement, advantages, disadvantages, and applications	
	17	Flame Emission Spectroscopy (FES) principle, measurement (single	2
		beam method) applications	
	18	Thermal methods: Themogravimetric analysis (TG) principle and	3
		method, Factors affecting thermogravimetric analysis, Application	
	19	Determination of Surface tension- capillary rise and stalagmometer	2
		method, Viscosity- Poiseuilles equation, Determination of viscosity-	
		Ostwald's viscometer, Refractive index determination by Abbe	
		refractometer	
V	PRA	CTICALS: PHYSICAL CHEMISTRY EXPERIMENTS	30
		A minimum of 5 practical experiments out of which at least one	
.1		each from sections I and II must be performed and reported.	
	20	I. Conductometry	8
	21	11. Determination of cell constant	
\sim		12. Conductometric titration of NaOH using HCl	
	22	II. Potentiometry	8
		13. Potentiometric titration of Fe^{2+} versus $Cr_2O_7^{2-}$	
		14. Potentiometric titration of KMnO4 versus KI	
	23	III. Surface tension:	
		15. Determination of Surface tension of any three liquids	8
		10. Surface tension of an unknown mixtures and determination of	

	 IV. Viscosity: 17. Determination of viscosity of any three liquids 18. Viscosity of binary mixtures and determination of concentration of an unknown mixture 	
24	 V. Refractive index experiments: 19. Determination of refractive indices of any three liquids 20. Refractive indices of KCl solutions of different concentrations and determination of concentration of unknown KCl solution 	6

References

- 1. B.R Puri, L R Sharma K C Kalia, *Principles of Inorganic Chemistry*, Sobhanlal Nagin Chand & Co. New Delhi.
- 2. Manas Chanda, *Atomic structure and Chemical bonding in molecular spectroscopy*, Tata Mc Graw Hill.
- 3. J D Lee, Concise Inorganic Chemistry, ELBS.
- 4. Miller T. G. Jr., *Environmental Science*, Wadsworth publishing House, Meerut Odum.E.P.1971.
- 5. Odum, E.P. (1971) Fundamentals of Ecology. Third Edition, W.B. Saunders Co., Philadelphia
- 6. S. E. Manahan, Environmental chemistry, 1993, Boca Raton, Lewis publisher
- 7. Environmental chemistry, Sharma and Kaur, 2016, Krishna publishers
- 8. Puri, Sharma, Pathania Principles of Physical Chemistry
- 9. B. K. Sharma, Instrumental methods of Chemical Analysis
- 10. D.A Skoog, D M West, F J, Holler, S R Crouch, *Fundamentals of Analytical Chemistry*, 8th Edn., Brookes/Cole, Thomson Learning, Inc, USA, 2004
- 11. B. K. Sharma, Soil and Noise pollution.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Discuss the chemicals affecting soils	U	PSO-1,2,3,4,5
CO-2	Get an insight in to petro chemical industry	U	PSO-1,2,3,4,5
CO3	Identify the water quality parameters.	Ap	PSO-1,2,3,4,5
CO 4	Couple different electrode and construct electrochemical cells	Ар	PSO-1,2,3,5
CO 5	Appreciate the use of sophisticated instruments	Ар	PSO-2,3,4,5
CO 6	Apply the basic principles in Physical chemistry experiments	Ар	PSO-1,2,3,4,5
CO 7	Identify the characteristics of given soil and water samples	Е	PSO-1,2,3,4,5

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create Name of the Course: CHEMICAL INSIGHTS: FROM SOIL TO PETROCHEMICALS

CO No.	СО	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	CO-1	PO- 1,6 PSO-1,2,3,4,5	U	F, C	L	B
2	CO-2	PO- 1,6 PSO-1,2,3,4,5	U	F, C	L	-
3	CO3	PO- 1,6 PSO-1,2,3,4,5	Ар	F, C	L	-
4	CO 4	PO- 1,2,3,6,7 PSO-1,2,3,5	Ap	F, C, P	L	-
5	CO 5	PO- 1,2,3,6,7 PSO-2,3,4,5	Ap	F, C, P	-	Р
6	CO 6	PO- 1,6 PSO-1,2,3,4,5	Ap	С, Р	-	Р
7	CO 7	PO- 1,2,3,6,7 PSO-1,2,3,4,5	Е	С, Р, М	-	Р

Credits: 4:0:0 (Lecture:Tutorial:Practical)

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	3	3	3	3	3	1	-	-	-	_	2	-	-
CO 2	3	3	3	3	3	1	-	-	-	-	2	-	-
CO 3	3	3	3	3	3	1	-	-	-	-	2	-	-
CO 4	3	3	2	-	2	1	2	2	-	-	2	2	-
CO 5	-	2	3	2	2	1	2	2	-	_	2	2	-
CO 6	3	2	2	1	2	1	-	-	-	_	2	-	-
CO 7	1	3	3	3	2	1	2	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:

sment F	Rubrics:			JS.					
 Quiz / Assignment/ Quiz/ Discussion / Seminar 									
•	Midterm Exam	l							
•	Programming A	Assignments							
•	Final Exam								
M	apping of Cos t	o Assessment	Rubrics:	A S					
	Internal Exam	Assignment	Project Evaluation	End Semester Examinations					
CO 1	\checkmark	\checkmark		\checkmark					
CO 2	\checkmark	\checkmark		✓					
CO 3	\checkmark		\checkmark	\checkmark					
CO 4	\checkmark		X	\checkmark					
CO 5	\checkmark			\checkmark					
CO 6	\checkmark			\checkmark					
CO 7	\checkmark		\checkmark	\checkmark					

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