Sarvajanik University

Sarvajanik College of Engineering & Technology, Surat

Bachelor of Technology (B. Tech.)

B. Tech. Semester I/II

Subject Name: Engineering Chemistry **Subject Code: BTAS11106**

Type of course: Basic Science
Prerequisite: Fundamentals of Organic/Inorganic/Physical/Analytical Chemistry.
Rationale: Material/Substance studies is the hearth of understanding the Applied Chemistry which further helps in preparing ground to understand engineering better.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
2	0	2	3	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Periodic Properties and Molecular Structure:** Rules for filling electrons in orbital – Aufbau, Pauli's exclusion and Hund's Principle, Variations of s, p, d and f orbital energies of atoms in the periodic table, Electronic configuration, Ionization energies, Electron affinity and Electronegativity, Oxidation states, Types of Bonds, Crystal Field Theory for transition metal ions	4	50%
2.	**Water Chemistry:** Introduction, Sources of water, Impurities in water, Water as a green Solvent, Hardness of Water, Boiler Problems, Softening of water (External & Internal treatments), Domestic water treatments, Waste water treatments, Desalination of Brackish water, Reuse of Brine.	5	
3.	**Metals, Alloys and Corrosion:** Properties of Metals, Definition and purpose of alloys, Classification of alloys, Industrial applications of Steel, Cu and Al alloys, Introduction to Corrosion, Theories of corrosion, Preventive measurements against corrosion like – Cathodic protection, Use of Inhibitors etc.	6	

Sr. No.	Topics	Teaching Hrs.	Module Weightage
4.	**Polymers and Fibres:** Introduction, Classification based on structure and molecular forces, Polymerization methods and its mechanism, Biodegradable Polymers, Commercially important polymers- PE, PP, Polycarbonates, Polyurethanes and their uses, Different types of fibres, Physical properties and uses of fibres.	5	40%
5.	**Important Engineering Materials:** **(a) Portland Cement:** Manufacture, Setting and Hardening Property. **(b) Fuels:** Bio fuels and their importance. **(c) Nano Materials:** Synthesis methods and Applications. **(d) Cells:** Different types of cells and their working, Batteries and Fuel Cell. **(e) Piezo, Pyro Smart Electrical materials:** Comparison of conventional and new ceramic based materials.	7	
6.	**Analytical Techniques:** Measurement and understanding of pH, Conductance, and Potential, Introduction of Spectroscopic techniques, Principles of spectroscopy and selection rules, UV-Visible Spectroscopy and its Applications.	3	10%

Suggested Specification Table of Marks as per Bloom's Taxonomy (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**30**	**40**	**10**	**0**	**0**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels.

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Engineering	P. C. Jain and Monika	Dhanpat Rai	2020	17th

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
	Chemistry	Jain	Publishing Co ISBN-978-93-5216-720-3		
2.	Engineering Chemistry	Jaya Shree Anireddy	Wiley India Pvt. Ltd, ISBN-978-81-265-0447-3	2019	1st
3.	A Textbook of Engineering Chemistry	S.S.Dara & S.S.Umare	S Chand Publishing ISBN- 978-81-2190-359-2	1986	12th
4.	Engineering Chemistry	N. Krishnamurthy, P. Vallinaygam and D. Madhavan	Prentice Hall of India Pvt. Ltd ISBN-978-81-203-5026-7	2019	4th
5.	Engineering Chemistry	K. Sesha Maheswaramma and Mridula Chugh	Pearson India Education Pvt. Ltd. ISBN-978-93-3257-118-1	2016	1st
6.	Engineering Chemistry	B K. Sharma	Krishna Prakashan. Media (P) Ltd ISBN- 978-81-8283-187-2	2020	7th
7.	Engineering Chemistry Fundamental and Application	Shikha Agrawal	Cambridge University Press ISBN- 978-11-2872-444-9	2019	2nd
8.	Introduction to Nano Science	S M. Lindsay	Oxford University Press ISBN- 978-0199544219	2009	Ist

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
9.	Nano Materials	A. K Bandyopadhyay	New Age International Publishers ISBN-978-81-224-2257-3	2009	Ist

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Relate periodic properties such as ionization potential, oxidation states and electro negativity. *(R,U - Cognitive level)*	10
CO-2	Analyse microscopic chemistry in terms of atomic and molecular orbital's and intermolecular forces. *(U,A,N - Cognitive level)*	10
CO-3	Describe the importance and application of engineering materials *(U,A - Cognitive level)*	40
CO-4	Interpret the methods of functional chemistry as a logical means of problem solving. *(R,A,N -Cognitive level)*	30
CO-5	Distinguish the ranges of the electromagnetic spectrum used and apply it for exciting different molecular energy levels in various spectroscopic techniques and use it further to derive the logical issues. *(U,A,N -Cognitive level)*	10

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	1	-	-	-	-	-	-	-	-	-	-			
CO-2	3	2	-	1	-	-	1	-	-	-	-	1			
CO-3	3	2	3	-	1	-	1	-	-	-	-	-			
CO-4	3	1	3	1	2	1	1	-	-	-	-	1			
CO-5	3	2	1	3	2	1	1	-	-	-	-	-			

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
Rationale*	15	8	7	5	5	2	4	-	-	-	-	2			

***Rationale:**
All CO are compatible and matching to the derived PO's to several extents. Various innovative engineering materials and its application help to derive and form new products which satisfy the societal needs of sustainable development and further justify the programmes outcomes.

LIST OF PRACTICALS: (Minimum 8 to be performed.)

1. Analysis of Steel Sample.
2. Analysis of Pyrolusite Ore.
3. Analysis of Brass Alloy.
4. Estimation of Total Hardness.
5. Determination of Concentration of Unknown Solution Spectrophotometrically.
6. Determination of pH and Conductance of the given solution.
7. Determination of Alkalinity of a given Water Sample.
8. Determination of Saponification value of oil.
9. Determination of chloride content of water.
10. Study of Pyrolysis reaction of $ZnCO_3$.
11. Determination of moisture content in Coal.
12. Estimation of NH_3 & NH_4Cl in given water sample.
13. Gravimetric estimation of Na_2CO_3 & $NaHCO_3$.
14. Study Wet Corrosion loss of Steel by weight loss method using electrochemical theory.
15. Stress Corrosion Cracking of Brass in NH_3 Solution.

Reference Books (Practical):

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of Publication	Publication Edition
1.	Laboratory Manual of Engineering Chemistry	S K. Bhasin & Sudha Rani	Dhanpat Rai Publishing Company Ltd ISBN-978-93-84378-31-8	2015	2nd

2.	Engineering Chemistry with Laboratory Experiments	M S. Kaurav	PHI Learning Pvt. Ltd. ISBN-9788120341746	2011	1st
3.	Vogel's textbook of Quantitative Chemical Analysis	Arthur I Vogel, Revised by Jeffery et al	Addison Wesley, Longman Ltd ISBN- 0-582-44693-7	1989	5th

Major Equipment:

1. Spectrophotometer
2. pH meter
3. Conductivity meter
4. Refractometer
5. Viscometer
6. Magnetic stirrer
7. Chemistry Glassware and Apparatus

List of Open Source/Learning website:

- https://vlab.amrita.edu/?sub=2
  - It's an online lab of chemical science possessing the virtual practicals of Organic/Physical/Inorganic and Analytical Chemistry.
- https:// https://nptel.ac.in/courses/104/101/104101090/
  - It covers basic of Structure and Periodic properties of elements and detail of bond theory and chemistry of group elements.
- https://nptel.ac.in/courses/105/104/105104102/
  - Its covers the basics of water and waste water treatment.
- https://nptel.ac.in/courses/113/104/113104082/
  - It covers the basics of corrosion and different types of corrosion.
- https://nptel.ac.in/courses/104/105/104105124/
  - It covers the basic of Polymer and Polymer science.
- https://nptel.ac.in/courses/104/106/104106122/
  - It covers Introduction to Spectroscopy and spectroscopic techniques.
- https://nptel.ac.in/courses/112/104/112104203/
  - It covers the different engineering materials.

List of Open Software: Nil