GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma Engineering in Mechanical/ Civil/ Electrical/Computer / Information Technology/ Agriculture/Biomedical / Electronics & Communication				
Semester	I & II		Version	1.0.0.0	
Effective from Academic Year	2025-26		Effective for the batch Admitted in		JULY 2025
Course code	1BS1103	Course Name	Applied Chemistry		

I.TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course Code	Learning Scheme						Assessment Scheme										
		Actual Contact Hrs./Week			SLH	NLH	Credits	Theory				Practical				Based on SL		Total Marks
		CL	TL	LL				FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL		SLA		
								MAX	MAX	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MIN	
DSC	1BS1103 Applied Chemistry	2	-	2	0	4	2	40	60	100	40	30	20	50	30			150

Abbreviation:	**CL-** Classroom Learning	**TL -** Tutorial Learning	**LL -** Laboratory Learning
	SLH - Self Learning Hours	**NLH -** Notional Learning Hours	**SLA -** Self Learning Assessment
	FA - Formative Assessment (Term work +Mid Sem Exam +Attendance)		**SA -** Summative Assessment

II. PRE-REQUISITES

Basic knowledge of Applied Chemistry.

III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES

Apply chemistry knowledge to solve engineering problems, select and use appropriate materials, prevent corrosion, operate lab equipment safely, support electrochemical processes, use lubricants and insulators, follow safety protocols, document findings, communicate effectively, and adapt to new industrial technologies.

IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes:

CO1. Understand and explain the fundamental concepts of chemical bonding and classify various types of chemical reactions using balanced chemical equations.

CO2. Understand and apply the concepts of acids, bases, pH, and buffer solutions to analyse their chemical properties and reactions in aqueous media.

CO3. Describe the physical and chemical properties of metals and explain types, causes, and preventive methods of corrosion.

CO4. Explain ionization, differentiate electrolytes and non-electrolytes, and describe electrochemical cells and industrial applications of electrochemical cells, electrolysis and emf series.

CO5. Identify and explain the types, properties, and uses of engineering materials like polymers, rubber, lubricants, insulators, refractories, adhesives, cement, and glass.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:				
Name of Unit	**Theory Learning outcomes (TLO's) aligned to CO's**	**Learning Content mapped with Theory Learning outcomes (TLO's) & CO's**	**Marks**	**Hours**
Unit-1 Chemical Bonding, Catalysis, and Types of Chemical Reactions	**TLO 1.1** Describe the theory of valency and types of chemical bonds with their characteristics. **TLO1.2** Define catalysis and catalyst; explain types of catalysis, and the roles of catalytic promoters and inhibitors. **TLO1.3** Write and balance chemical equations correctly. **TLO1.4** Classify and explain various types of chemical reactions with examples.	**1.1** Theory of Valency, Types and Characteristics of Chemical Bonds **1.2** Definition and Types of Catalysis & Catalyst, Catalytic Promoter and Inhibitor **1.3** Writing and Balancing Chemical Equations **1.4** Combination, Decomposition, Displacement, and Double Displacement Reactions	**10**	**4**
Unit-2 **Chemical Properties of Acids and Bases and the Concept of pH**	**TLO 2.1** Explain the concepts of acids and bases and their chemical properties. **TLO 2.2** Identify and differentiate the physical properties of metals and non-metals, and explain the chemical behavior of metals based on their reactions with oxygen, water, acids, and salts." **TLO 2.3** Describe and analyze reactions of metallic oxides with acids and acid/base reactions in aqueous solutions. **TLO 2.4** Define pH, calculate pH values using numerical problems, and explain its significance in various real-life applications. **TLO 2.5** Define buffer solution and classify its types with examples.	**2.1** Concepts of acids and bases, chemical properties of acids and bases. **2.2** physical properties of metals and non-metals and chemical properties of metals. **2.3** Reaction of metallic oxides with acids; reactions of acids and bases in water solutions. **2.4** Definition of pH, importance of pH in various fields, numerical examples. **2.5** Definition and types of buffer solution.	**12**	**5**

Unit-3 **Physical and Chemical Properties of Metals and Corrosion Prevention**	**TLO 3.1** Distinguish between physical properties of metals and non-metals. **TLO 3.2** Explain chemical properties of metals with relevant examples. **TLO 3.**3 Define corrosion and identify different types of corrosion such as pitting, waterline, and crevice corrosion. **TLO 3.4** Analyze the factors affecting the rate of corrosion, such as film nature, environment, pH, temperature, and metal purity. **TLO 3.5** Describe methods for prevention of corrosion including protective coating, cathodic/anodic protection, and material design.	**3.1** Physical properties of metals and non-metals **3.2** Chemical properties of metals **3.3** Definition and types of corrosion **3.4** Factors affecting corrosion rate **3.5** Methods of corrosion prevention	**12**	**5**
Unit-4 **Concepts of Electro Chemistry**	**TLO 4.1** Define ionization and explain Arrhenius theory of ionization. **TLO 4.2** Explain the concept of degree of ionization and identify the factors that affect it. **TLO 4.3** Distinguish between electrolytes and non-electrolytes with examples. **TLO 4.4** Describe the construction and working of an electrochemical cell. **TLO 4.5** Explain the role and function of the Standard Hydrogen Electrode and half-cell potential. **TLO 4.6** Interpret the electrochemical (emf) series and its significance. **TLO 4.7** Describe industrial applications of electrolysis, including electro-refining, electroplating, and electro-typing.	**4.1** Introduction to electrochemistry, Arrhenius theory of ionization **4.2** Degree of ionization, factors affecting ionization **4.3** Electrolytes and non-electrolytes **4.4** Construction and working of electrochemical cell. **4.5** Standard Hydrogen Electrode, half-cell potential. **4.6** emf series and its industrial relevance. **4.7** Industrial applications of electrolysis: electro-refining, electroplating, electro-typing.	**12**	**7**

Unit-5 **Properties, Classification, and Applications of Lubricants, Polymers, Insulators, and Industrial Engineering Materials**	**TLO 5.1** Classify polymers and describe the synthesis, properties, and uses of common thermoplastics and thermosetting plastics. **TLO 5.2** Explain the structure and properties of natural rubber, and describe vulcanization and applications of rubber. **TLO 5.3** Define insulating materials and classify them with examples like glass wool and thermocol. **TLO 5.4** Define lubricants, classify them, and explain their physical and chemical properties with selection criteria. **TLO 5.5** Define refractories and describe their types, properties, and industrial applications. TLO 5.6 Explain the composition, types, and uses of paints and varnishes. TLO 5.7 Define adhesives, classify them, and describe their properties and industrial applications. TLO 5.8 Explain the composition, manufacturing process, setting, and hardening of Portland cement. TLO 5.9 Describe the types, properties, and applications of glass in engineering.	**5.1** Polymers: Classification, synthesis, properties, applications (e.g., polyethylene, PVC, polystyrene, etc.) **5.2** Rubber: Natural rubber, vulcanization, and properties **5.3** Insulating materials: Definition, classification, properties (glass wool, thermocol) **5.4** Lubricants: Types, physical and chemical properties, selection **5.5** Refractories: Definition, classification, properties, applications **5.6** Paints and varnishes: Composition, types, properties, applications **5.7** Adhesives: Definition, types, properties, applications **5.8** Cement: Composition, manufacturing, setting and hardening **5.9** Glass: Types, general properties, engineering applications	**14**	**9**

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL			
Sr. No.	**Practical/Laboratory Learning Outcome (LLO)**	**Practical Titles**	**Relevant COs**
1	**LLO1.1** Follow standard laboratory safety rules and demonstrate proper handling and operation of basic chemistry lab equipment	Introduction to Laboratory Safety Rules and Demonstration of Basic Chemistry Equipment	CO1

2	**LLO 2.1** Perform accurate titration to determine the concentration of a strong acid or strong base and calculate molarity using appropriate indicators.	Volumetric Analysis: Strong Acid–Strong Base Titration	CO2
3	**LLO 3.1** Analyze titration results involving a strong acid and weak base, and select suitable indicators based on pH range.	Volumetric Analysis: Strong Acid–Weak Base Titration	CO2
4	**LLO 4.1** Measure and compare the pH of various solutions using both universal indicators and pH meter and interpret the results.	Determination of pH Using Universal Indicator and pH Meter	CO2
5	**LLO 5.1** Investigate the effect of pH on corrosion rate of metals and conclude the most corrosive conditions.	Study of Corrosion of Metals in Media with Different pH Values	CO3
6	**LLO 6.1** Analyze and compare the corrosion behavior of metals in different environmental conditions (e.g., air, water, acid, base).	Study of Corrosion of Metals in Different Environmental Mediums	CO3
7	**LLO 7.1** Explain and demonstrate the construction and working of an electrochemical cell, electrolyte cell and understand the electrochemical series.	Construction and Working of Electrochemical and Electrolytic Cells	CO4
8	**LLO 8.1** Measure the viscosity of a liquid using Redwood viscometer and relate viscosity with molecular interactions.	Determination of Viscosity of a Liquid Using Redwood Viscometer	CO5
9	**LLO 9.1** Determine the flash and fire point of lubricating oil using Pensky-Martens or Abel's apparatus and evaluate its safety for usage.	Determination of Flash and Fire Point of a Lubricating Oil	CO5
10	**LLO 10.1** Identify the composition and properties of cement and concrete, and understand their roles in civil engineering applications.	Study of Composition and Properties of Cement and Concrete	CO5
11	**LLO 11.1** Understand the parts and working of a metallurgical microscope and demonstrate proper handling techniques.	Study and Operation of Metallurgical Microscope	CO5

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

- Teacher guided self-learning activities.
- Course/topic-based internet-based assignments.
- Library survey regarding Engineering Material used in different industries.
- Industrial Visits of one or Two Industries.
- Quiz & Brain storming session related to Polymeric materials.
- Sampling & Testing of water collected from different places.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD

1	Chemical balance, Glassware and Plasticware identification chart (like Test tubes, beakers, burettes with stand, pipettes, funnels, Measuring cylinders, wash bottle, Buffer solutions, Thermometer, etc.)
2	Standard solutions (HCl, H_2SO_4, NaOH, NH_4OH or similar acid and base), Phenolphthalein, Methyl orange and appropriate pH indicator
3	Digital pH meter with electrodes
4	Desiccator
5	Electrochemical cell trainer kit
6	Redwood Viscometer (No. 1 or 2)
7	Pensky-Martens Apparatus or Abel's Flash Point Apparatus
8	Metallurgical Microscope

IX. LIST OF REFERENCE BOOKS

Sr. No.	Title	Author	Publication
1	Engineering Chemistry	JAIN & JAIN	Dhanpat Rai and Sons
2	A Text Book of Polytechnic Chemistry	V.P. Mehta	Jain Brothers
3	A Text Book of Applied Chemistry	J. Rajaram	Tata McGraw Hill Co. New Delhi
4	Engineering Chemistry	S.S. Dara	S. Chand Publication
5	Industrial Chemistry	B.K. Sharma	Krishna Publication

X. LINK OF LEARNING WEB RESOURCE

1	https://www.youtube.com/watch?v=2JpZCe_dG6U - General Chemistry (Theory + Practical)
2	https://vlab.amrita.edu/?sub=2 – Amrita VLab (Govt of India)
3	https://www.khanacademy.org/science/chemistry - Corrosion and Electrochemistry
4	https://nptel.ac.in/courses/122102008 – NPTEL IIT Kharagpur
5	https://nptel.ac.in/courses/113106064 – Material Science Course

6	https://phet.colorado.edu/en/simulations/category/chemistry - Science Animation & Simulations
7	https://gtu-paper-solution.com/gtu-applied-chemistry/ - Applied Chemistry Notes (Diploma Gujarat GTU)

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Chemical Bonding, Catalysis, and Types of Chemical Reactions	CO1	4	2	5	3	10
2	Chemical Properties of Acids and Bases and the Concept of pH	CO2	5	2	6	4	12
3	Physical and Chemical Properties of Metals and Corrosion Prevention	CO3	5	2	6	4	12
4	Concepts of Electro Chemistry	CO4	7	2	5	5	12
5	Properties, Classification, and Applications of Lubricants, Polymers, Insulators, and Industrial Engineering Materials	CO5	9	2	6	6	14
		Grand Total	30	10	28	22	60

XII. COs AND POs AND PSOs MAPPING

Course outcome (Cos)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	0	1			
CO2	3	3	2	2	1	0	1			
CO3	3	3	2	2	2	1	1			
CO4	3	2	2	3	1	1	2			
CO5	3	2	2	2	3	1	2			

Legends: - *3- High* *2-Moderate/Medium* *1-Slight/Low* *0-None*