

**Shree Manibhai Virani and Smt. Navalben Virani Science College
(Autonomous), Rajkot
Affiliated to Saurashtra University, Rajkot**

B. Voc. Chemical Technology

**Scheme of Instruction and Examinations
For Students Admitted from A.Y. 2017-2018 & Onwards**

Semester– I							
Course Code	Course	Hrs. of Instruction/ week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
Part - I							
17VLCEN01	Functional English	3	3	40	60	100	3
Part - II							
17VCTGC01	Core 1 : Fundamental Chemistry-I	3	3	30	70	100	3
17VCTGC02	Core 2 : Fundamental Industrial Chemistry-I	3	3	30	70	100	3
17VCTGC03	DSE-Allied 1: Elementary Physics	3	3	30	70	100	3
17VCTSC01	Core Skill 1: Fundamental Chemistry-I Practical	6	3	40	60	100	6
17VCTSC02	Core Skill 2: Fundamental Industrial Chemistry-I Practical	6	3	40	60	100	6
17VCTSC03	DSE-Allied Skill 1: Elementary Physics Practical	3	3	20	30	50	3
17VCTSC04	DSE-Allied Skill 2: Office Automation Tools Practical	3	3	20	30	50	3
		30				700	30
Part - III							
17VAEES01	AECC 1: Environmental Science	1	-	-	-	-	-
17VAEVE01	SEC 1: Value Education –I	1	-	Remarks			1
		32					

Semester – II							
Course Code	Course	Hrs. of Instruction/week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
Part - I							
16VLCEN02	Business Communicative English	3	3	40	60	100	3
Part - II							
17VCTGC04	Core 4 : Analytical & Electro Chemistry	3	3	30	70	100	3
17VCTGC05	Core 5: Chemistry of Surfactants	3	3	30	70	100	3
17VCTGC06	Core 6 : Surface Coating Techniques	3	3	30	70	100	3
17VCTSC05	Core Skill 5 : Analytical & Electro Chemistry Practical	6	3	40	60	100	6
17VCTSC06	Core Skill 6: Chemistry of Surfactants Practical	3	3	20	30	50	3
17VCTSC07	Core Skill 7 : Surface Coating Techniques Practical	3	3	20	30	50	3
17VCTSC08	Core Skill 8: Skill Training/ IDP (Industry/Institute Defined Project)	6	3	40	60	100	6
		30				700	30
Part - III							
17VAEES02	AECC 1 : Environmental Science	1	-	Remarks			2
17VAEVE02	SEC 2: Value Education –II	1	-	Remarks			1
		32					

Semester – III							
Course Code	Course	Hrs. of Instruction/week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
Part - II							
17VCTGC07	Core 7 : Fundamental Chemistry-II	3	3	30	70	100	3
17VCTGC08	Core 8 : Fundamental Industrial Chemistry-II	3	3	30	70	100	3
17VCTGC09	Core 9: Industrial Unit Process & Operations	3	3	30	70	100	3
17VCTGC10	Core 10: Water Analysis	3	3	30	70	100	3
17VCTSC09	Core Skill 9: Fundamental Chemistry-II Practical	6	3	40	60	100	6
17VCTSC10	Core Skill 10: Fundamental Industrial Chemistry-II Practical	3	3	20	30	50	3
17VCTSC11	Core Skill 11: Industrial Unit Process & Operations Practical	3	3	20	30	50	3
17VCTSC12	Core Skill 12: Water Analysis Practical	6	3	40	60	100	6
	Total	30				700	30

Semester – IV							
Course Code	Course	Hrs. of Instruction/week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
Part - II							
17VCTGC11	Core 11: Petroleum & Petrochemicals	3	3	30	70	100	3
17VCTGC12	Core 12: Chemistry of Polymer & Composite materials	3	3	30	70	100	3
17VCTGC13	Core 13: Polymer Technology	3	3	30	70	100	3
17VCTGC14	Core 14: Petroleum Analysis	3	3	30	70	100	3
17VCTSC13	Core Skill 13: Chemistry of Polymer & Composite materials Practical	6	3	40	60	100	6
17VCTSC14	Core Skill 14: Polymer Technology Practical	3	3	20	30	50	3
17VCTSC15	Core Skill 15: Petroleum Analysis Practical	3	3	20	30	50	3
17VCTSC16	Core Skill 16: Skill Training / IDP (Industry/Institute Defined Project)	6	3	40	60	100	6
		30				700	30

Semester - V							
Course Code	Course	Hrs. of Instruction/ week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
Part - II							
17VCTGC15	Core 15: Stereo Chemistry & Organic reaction Mechanism	3	3	30	70	100	3
17VCTGC16	Core 16: Biochemistry	3	3	30	70	100	3
17VCTGC17	Core 17: MAT- Modern Analytical Techniques	3	3	30	70	100	3
17VCTGC18	Core 18: Pharmaceutical (Medicinal) Chemistry	3	3	30	70	100	3
17VCTSC17	Core Skill 17: Stereo Chemistry & Organic reaction Mechanism Practical	6	3	40	60	100	6
17VCTSC18	Core Skill 18: Biochemistry Practical	3	3	20	30	50	3
17VCTSC19	Core Skill 19: MAT- Modern Analytical Techniques Practical	6	3	40	60	100	6
17VCTSC20	Core Skill 20: Pharmaceutical (Medicinal) Chemistry Practical	3	3	20	30	50	3
	Total	30				700	30

Semester - VI							
Course Code	Course	Hrs. of Instruction/ week	Exam Duration (Hours)	Maximum Marks			Credits
				CIE	SEE	Total	
Part II							
17VCTGC19	Core 19 : Pharmaceutical Engineering	3	3	30	70	100	3
17VCTGC20	Core 20: Pharmaceutical Technology	3	3	30	70	100	3
17VCTGC21	Core 21: Industrial Formulation & GLP	3	3	30	70	100	3
17VCTGC22	Core 22: Entrepreneurship Development & Soft Skill Training	3	-	Remarks			3
17VCTSC21	Core Skill 21 : Pharmaceutical Engineering Practical	6	3	40	60	100	6
17VCTSC22	Core Skill 22: Pharmaceutical Technology Practical	3	3	20	30	50	3
17VCTSC23	Core Skill 23: Industrial Formulation & GLP Practical	3	3	20	30	50	3
17VCTSC24	Core Skill 24: In-plant Training / IDP (Industry/Institute Defined Project)	6	3	40	60	100	6
		30				600	30
Total Marks : 4100							

Part - III						
Course Code	Semester	Particulars	Hrs of instruction/week	No. of Courses	Credit/Course	Total Credits
<i>Ability Enhancement Compulsory Course (AECC)</i>						
As per common list	I & II	AECC-I Environment Science	1	1	2	2
	IV & V	AECC-II Communication Skill/Soft Skills	2	2	1	2
					Sub Total	4
<i>Skill Enhancement Course (SEC)</i>						
As per common list	I	SEC-I Value Education-I	1	1	1	1
	II	Value Education-II	1	1	1	1
	Any Semester between II - V	SEC-II *Co-Curricular Course	> 40 hours in total	1	1	1
	Any Semester between II - V	SEC-III **Value Added Courses	40 hours in total	1	1	1
					Sub Total	4
					Grand Total	8

***Co-Curricular Courses** - Option to students to choose 1 from a list of courses offered by the college, such as Add on Courses, Gandhian Studies Certificate Course, Women Studies Course, etc.

****Value Added Courses** - Option to student to choose at least 1 from a list of courses offered by UG departments.

• **TOTAL MARKS & CREDIT DISTRIBUTION**

S.N.	PART	Total Marks	Total Credits
1.	PART I: Language Course	200	6
2.	PART II (Core): a) General Education b) Skill Education	3900	174
3.	PART III: AECC-I & II, SEC-I,II&III	Remarks	08
TOTAL		4100	180 + 8

PART – I : LANGUAGE COURSE

The following are compulsory courses offered in first and Second semesters.

S. N.	Semester	Course Code	Course
1.	I	17VLCEN01	Functional English
2.	II	16VLCEN02	Business Communicative English

PART – II (General Education, Skill Education) :

• CORE COURSES [General Education - Theory]

S. N.	Semester	Course code	Course
1.	I	17VCTGC01	Core 1 : Fundamental Chemistry-I
2.		17VCTGC02	Core 2 : Fundamental Industrial Chemistry-I
3.	II	17VCTGC04	Core 4 : Analytical & Electro Chemistry
4.		17VCTGC05	Core 5 : Chemistry of Surfactants
5.		17VCTGC06	Core 6 : Surface Coating Techniques
6.	III	17VCTGC07	Core 7 : Fundamental Chemistry-II
7.		17VCTGC08	Core 8 : Fundamental Industrial Chemistry-II
8.		17VCTGC09	Core 9 : Industrial Unit Process & Operations
9.		17VCTGC10	Core 10 : Water Analysis
10.	IV	17VCTGC11	Core 11 : Petroleum & Petrochemicals
11.		17VCTGC12	Core 12 : Chemistry of Polymer & Composite materials
12.		17VCTGC13	Core 13 : Polymer Technology
13.		17VCTGC14	Core 14 : Petroleum Analysis
14.	V	17VCTGC15	Core 15 : Stereo Chemistry & Organic reaction Mechanism
15.		17VCTGC16	Core 16 : Biochemistry
16.		17VCTGC17	Core 17 : MAT- Modern Analytical Techniques
17.		17VCTGC18	Core 18 : Pharmaceutical (Medicinal) Chemistry
18.	VI	17VCTGC19	Core 19 : Pharmaceutical Engineering
19.		17VCTGC20	Core 20 : Pharmaceutical Technology
20.		17VCTGC21	Core 21 : Industrial Formulation & GLP
21.		17VCTGC22	Core 22 : Entrepreneurship Development & Soft Skill Training

• DISCIPLINE SPECIFIC ELECTIVE-ALLIED (DSE-Allied) COURSES

S. N.	Semester	Course Code	Course
1.	I	17VCTGC03	DSE-Allied 1 : Elementary Physics
2.	II	17VCTSC03	DSE-Allied Skill 1 : Elementary Physics
3.		17VCTSC04	DSE-Allied Skill 2 : Office Automation Tools

• **CORE COURSES [Skill Education - Practical]**

S. N.	Semester	Course code	Course
1.	I	17VCTSC01	Core Skill 1: Fundamental Chemistry-I Practical
2.		17VCTSC02	Core Skill 2: Fundamental Industrial Chemistry-I Practical
3.		17VCTSC03	Core Skill 3: Elementary Physics Practical
4.		17VCTSC04	Core Skill 4: Office Automation Tools Practical
5.	II	17VCTSC05	Core Skill 5 : Analytical & Electro Chemistry Practical
6.		17VCTSC06	Core Skill 6: Chemistry of Surfactants Practical
7.		17VCTSC07	Core Skill 7 : Surface Coating Techniques Practical
8.	III	17VCTSC09	Core Skill 9: Fundamental Chemistry-II Practical
9.		17VCTSC10	Core Skill 10: Fundamental Industrial Chemistry-II Practical
10.		17VCTSC11	Core Skill 11: Industrial Unit Process & Operations Practical
11.		17VCTSC12	Core Skill 12: Water Analysis Practical
12.	IV	17VCTSC13	Core Skill 13: Chemistry of Polymer & Composite materials Practical
13.		17VCTSC14	Core Skill 14: Polymer Technology Practical
14.		17VCTSC15	Core Skill 15: Petroleum Analysis Practical
15.	V	17VCTSC17	Core Skill 17: Stereo Chemistry & Organic reaction Mechanism Practical
16.		17VCTSC18	Core Skill 18: Biochemistry Practical
17.		17VCTSC19	Core Skill 19: MAT- Modern Analytical Techniques Practical
18.		17VCTSC20	Core Skill 20: Pharmaceutical (Medicinal) Chemistry Practical
19.	VI	17VCTSC21	Core Skill 21 : Pharmaceutical Engineering Practical
20.		17VCTSC22	Core Skill 22: Pharmaceutical Technology Practical
21.		17VCTSC23	Core Skill 23: Industrial Formulation & GLP Practical

• **OTHER CORE COURSES**

S. N.	Semester	Course Code	Course
1	II	17VCTSC08	Core Skill 8: Skill Training/ IDP (Industry/Institute Defined Project)
2	IV	17VCTSC16	Core Skill 16: Skill Training / IDP (Industry/Institute Defined Project)
3	VI	17VCTSC24	Core Skill 24: In-plant Training / IDP (Industry/Institute Defined Project)

• PART –III : AECC&SEC

Part - III						
Course Code	Semester	Particulars	Hrs of instruction/week	No. of Courses	Credit/Course	Total Credits
<i>Ability Enhancement Compulsory Course (AECC)</i>						
As per common list	I & II	AECC-I Environment Science	1	1	2	2
	IV & V	AECC-II Communication Skill/Soft Skills	2	2	1	2
					Sub Total	4
<i>Skill Enhancement Course (SEC)</i>						
As per common list	I	SEC-I Value Education-I	1	1	1	1
	II	Value Education-II	1	1	1	1
	Any Semester between II - V	SEC-II *Co-Curricular Course	> 40 hours in total	1	1	1
	Any Semester between II - V	SEC-III **Value Added Courses	40 hours in total	1	1	1
					Sub Total	4
					Grand Total	8

***Co-Curricular Courses** - Option to students to choose 1 from a list of courses offered by the college, such as Add on Courses, Gandhian Studies Certificate Course, Women Studies Course, etc.

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Syllabus – B. Voc. Chemical Technology – Semester I-II

For Students Admitted from A.Y. 2017-2018 & Onwards

SEMESTER I

17VLCEN01	Functional English	3 Hrs/Wk
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SEMESTER I

17VCTGC01	Core 1 : Fundamental Chemistry-I	3 Hrs/Wk
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Course Outcomes:

On the successful completion of the course, students will be able to:

- Understand the concepts and applications of atomic structure, periodic properties, bonding, shapes & stereochemistry of molecules, acid-base and buffer, qualitative analysis of simple organic & inorganic molecules, basic physical properties of chemicals including adsorption phenomena.
- Estimate and prepare solutions of standard concentration by applying the concepts mole and stoichiometry.
- Determine chemical and/or physical properties of simple chemicals by testing them and correlating concepts of molecular behaviour.
- Interpret the results and draw conclusion of test results.

Unit-1: Atomic Structure & Periodic Properties (9 Hours)

1. Atomic Structure and properties:

The atomic concept, electromagnetic radiation and quantization, wave-particle duality of light, shapes of atomic orbital,

- #### 2. Atomic properties and periodicity:
- Explanation and General Trends of the following Periodic Properties (a) Atomic and Ionic Radii (b) Ionization Potential (c) Electro negativity (d) Electron affinity

Unit-2: Molecular Bonding & Behaviour (9 Hours)

- #### 1. Electronic structure and Bonding:
- Drawing Organic molecules, Ionic, Covalent and Polar Bonds, Functional groups, Inductive effect, resonance and hyper conjugation.

- #### 2. Acids-Bases and Buffers:
- Concepts of acid and bases, strengths of acid and bases, buffer solution, pH scale, pH of buffer solutions.

Unit-3: Solution and their Properties (9 Hours)

Solutions, energy changes and the solution process, units of concentration, factors affecting solubility, colligative properties, vapour-pressure lowering of solution: Rault's law, boiling point elevation and freezing point depression of solutions, osmosis, fractional distillation of liquid mixture

Unit-4: Thermodynamics (8 Hours)

Types and concept of system & surrounding, types of processes, state & path functions, intensive & extensive properties, concept of heat & work, concept of internal energy, enthalpy and entropy, Concept and inferences of first, second and zeroth Law of thermodynamics, Joule-Thomson effect and inversion temperature.

Unit-5: Qualitative Analysis (10 Hours)

- #### 1. Theory of qualitative inorganic analysis:
- Factors affecting qualitative analysis: common ion effect, solubility product (K_{sp}) Use of NH_4Cl and NH_4OH in Qualitative Analysis, Use of HCl and H_2S in Qualitative Analysis, Numerical on common ion effect and K_{sp} , Necessary explanation with chemical equations in (a) Charcoal test (b) Cobalt nitrate test (c) Borax bead test (d) Flame test.

2. **Theory of qualitative organic analysis:** Preliminary test, element determination test, functional group test, derivatisation.

Text Books

1. Organic Chemistry – B. S.Bahl and ArunBahl
2. Guide to Essentials of Physical Chemistry – B.S. Bahl, G.D. Tuli, and ArunBahl

Reference Books

3. Chemistry³ – Bullos-Holman-Parsons-Piling-Price.
4. Chemistry-McMurry Fay
5. Organic Chemistry-J. Clayden
6. Organic Chemistry-P.Bruice

SEMESTER I

17VCTGC02	Core 2 : Fundamental Industrial Chemistry-I	3 Hrs/Wk
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Course Outcomes:

On the successful completion of the course, students will be able to:

- Understand the concepts, functions, applications and requirement of instrumental analysis in industrial processes.
- Perform measurements by selecting and operating instruments based on types, characteristics, features and limitation of available instruments.
- Arrange instrument and follow practical procedure to perform analysis of temperature, viscosity, density, pressure, liquid level and flow measurements.
- Interpret measurement data and draw conclusion of test results.
- Design and/or use industrial instruments for measurements of temperature, viscosity, density, pressure, liquid level and flow of the involved system and recognise their significance.

Unit-1: Instrumental Measurements (9 Hours)

Instrumentation for measurement of Industrial parameters: Introduction, Functions of measuring instruments, Types of measurement, Elements of an instrument, Classification of measuring instrument, Characteristics of and instrument.

Unit-2: Temperature Measurements (9 Hours)

Introduction, Principle, Construction and Working of various types of Industrial Temperature measuring Instruments: Constant volume gas thermometer, Glass thermometer, Bimetallic thermometer, Pressure spring thermometer, Vapor actuated thermometer, Pneumatic balance pressure thermometer, Resistance thermometer, Industrial resistance thermometer bulbs (RT bulbs), Radiation temperature measurements, Laws of radiation, Radiation pyrometers, Vacuum thermocouple, Balometer, Photoelectric pyrometer, Optical pyrometer.

Unit-3: Viscosity & Density Measurements (9 Hours)

1. Viscosity Measurement:

Introduction, Principle, Construction and Working of various types of Industrial Viscosity measuring Instruments: Capillary Viscometer, Orifice type viscometer, Falling sphere viscometer, Rotational viscometer.

2. Density Measurement:

Introduction, Principle, Construction and Working of various types of Industrial Density measuring Instruments: Liquid level method of measuring specific gravity or density, Displacement meter for measuring specific gravity or density, Hydrometer.

Unit-4: Pressure Measurements (9 Hours)

Introduction, Principle, Construction and Working of various types of Industrial Pressure measuring Instruments: Liquid column manometer, U-tube manometer, Inclined manometer, Well type manometer, Ring type manometer, Barometer, Bourdon gauge, Bellow gauge, McLeod gauge, Thermal conductivity, gauge, Pirani gauge, Thermocouple gauge, Measuring pressure in corrosive fluids: Single coil siphon, Diaphragm seal, Liquid seal.

Unit-5: Liquid level & flow measurements

(9 Hours)

1. Liquid Level Measurement:

Introduction, Principle, Construction and Working of various types of Industrial Liquid Level measuring Instruments: Methods of liquid level measurement, Hook type level indicator, Sight glass, Float type level indicator, Pressure gauge method: Bubbler system, Diaphragm box system, Air-trap system, Radiation level indicator, Ultrasonic method for level measurement,

2. Flow Measurement:

Introduction, Principle, Construction and Working of various types of Industrial Flow measuring Instruments such as venturimeter, orificemeter, pitot tube.

Reference Books:

1. Industrial instrumentation by D.P. Eckman, John – Wiley's and sons.
2. Applied instrumentation in process industries, Volume I, II, & III, W.G.Andrews, Gulf publication.
3. Instrumentation and control for the process industries by S. Borer, Elsevireapplied science publisher.
4. Chemical engineers handbook, by J.H. Perry and D. Green, McGraw Hillpublishingcompany, New York.
5. Industrial chemistry by B.K. Sharma, Goel Publishers, New Delhi.

SEMESTER I

17VCTGC03	Core Skill 3: Elementary Physics	3 Hrs/Wk
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Course Outcomes:

On the successful completion of the course, students will be able to:

- Understand the concepts and differences of Electricity and Electronics based on governing laws and their applications like Batteries and LEDs.
- Recognise fundamentals of optics (both Ray and wave optics) leading to understanding and estimating the behaviour of light.
- Apply the understanding of magnetic, electromagnetic and mechanical behaviour of matter to conduct experiments, collect data and interpret properties of matter.
- Apply basic functions and laws of calculus to simplify complex mathematical problems; and apply numerical & statistical methods to find mean, median, mode and standard deviations for specified set of data.

Unit-1: Basics of Electricity

Ohm's Law and Concept of Resistance, Series and Parallel Connections of Resistance, e.m.f., internal resistance and terminal Voltage of cell, Whetstone Bridge and Potentiometer circuit.

Unit-2: Fundamental of Optics

Ray optics: Laws of reflection and mirror formula, Laws of refraction, change in height, depth, Image formation by lenses and Lens formula.

Wave optics: Interference. Young's experiment and condition of constructive and destructive interference, introduction to diffraction and polarization.

Unit-3: Properties of Matter

1. **Solid Mechanics:** Introduction to different elastic constant, Practical applications of elasticity, Fluid Mechanics: - Pascal Law and hydraulic lift, Viscosity and stock's law and terminal velocity, Molecular interpretation of surface tension

2. **Basics of Electromagnetism:**

Electrostatic Concept of electric field and potential, electric field and potential due to dipole, Electrical flux and Gauss law for electrical flux with application, Capacitor and capacitance, combination of capacitors and energy stored in capacitor

Magnetism: Bar Magnet and field of bar magnet, Classifications of materials on base of their magnetic properties

Unit-4: Basics of Electronics

Introduction to PN Junction Diode, LED and Photo Diode, Basics of Transistor and characteristics of transistor.

Unit-5:

SEMESTER II

17VCTGC04	Core 4 : Analytical & Electro Chemistry	3 Hrs/Wk
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Course Outcomes:

On the successful completion of the course, students will be able to:

- Balance chemical equations and calculate concentration of solutions based on mole concept and stoichiometric calculations.
- Measure concentration of analytes by selecting and performing suitable quantitative analysis; determine significance of the measured data by performing statistical data analysis.
- Design cell of desired EMF or measure EMF of any cell in accordance with Nernst equation, std. electrode potential, types and role of electrodes and liquid junction concepts of electro chemistry.
- Calibrate and Operate conductometer, pH meter and potentiometer to analyse concentration or presence of certain chemical entities.

Unit-1: Formulas, Equations and mole concept (8 Hours)

Balancing chemical equations, Avogadro's number and the mole concept, Stoichiometric Calculations, yields of chemical reactions, Concentration Concept with Numerical: Preparation and standardization of Solutions (1° & 2°), Equivalent weight of acid, base and salts, Molarity with numerical, Normality with numerical, Molality with numerical, Strength of solutions, % concentration w/v & v/v, Formality.

Unit-2: Theory of quantitative analysis (8 Hours)

Volumetric & Gravimetric analysis: Introduction, types, theory, indicators and applications.

Unit-3: Statistical Data Analysis (7 Hours)

Types of errors, Accuracy & precision, Data processing, Confidence limit & interval, Test of significance, t-test & F-test, Rejection of data, Control charts, Least square analysis, related problems

Unit-4: Electro chemistry (10 Hours)

Introduction, reversible and irreversible cell, measurement of EMF of cells, free energy and EMF of a cell reaction, measurement of entropy and enthalpy changes from Emf data, thermodynamics of electrode and cell potentials – Nernst equation, standard electrode potential – its measurement, representation of electrochemical cell and cell reaction from single electrodes, type of electrodes, other reference electrodes, classification of electrochemical cells, chemical cell, concentration cell, magnitude of liquid junction potential, application of EMF measurement.

Unit-5: Electro-analytical methods (12 Hours)

Basics & general concept of electro-analytical methods

- **Conductometry:** Introduction, Arrhenius ionic theory, conductivity of electrolytes, Conductance, factors affecting conductance, Kohlrausch law, conductivity cells, applications & advantages of conductometric titration.

- **Potential and pH metric methods:** introduction, acid – base neutralization titration, redox titration, precipitation titration.

Books Recommended:

1. A textbook of physical chemistry – A. S. Negi, S. C. Anad.
2. Engineering chemistry - R. Gopalan, D. Venkappayya, S. Nagarajan.
3. Chemistry in engineering and technology volume -1 & 2 – J.C. Kuriacose & J. Rajaram
4. Engineering chemistry – Jain & Jain
5. Industrial hygiene and chemical safety – M. K. Fulekar.
6. Guidelines on GMP/GLP by S. Lyer.
7. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West and F.J. Holler, W.B. Saunders.

SEMESTER II

17VCTGC05	Core 5: Chemistry of Surfactants	3 Hrs/Wk
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Course Outcomes:

On the successful completion of the course, students will be able to:

- Recognise surfactants or surface active agents by understanding adsorption and electrical double layer phenomena.
- Identify or select surfactant for specific application based on characteristic features of surfactants including some commercially available surfactants.
- Understand the process of micelle formation and reduction of surface & interfacial tension by surfactants, including dynamic surface tension reduction.
- Prepare simple surfactants of daily usage, recognise the role and chemistry of each ingredient, and measure important physico-chemical properties of them.

Unit-1: Chemistry of surfactants (9 Hours)

Introduction, definition & Fundamentals of Surfactants

Adsorption of Surface-Active Agents: The Electrical Double Layer, Adsorption at the Solid-Liquid

Unit-2: Characteristic Features of Surfactants (9 Hours)

Interfacial Phenomena and Surfactants, general structural features and behaviour of surfactants, characteristic features and uses of commercially available surfactants, types of Surfactants (i.e. Anionics, Cationics, Nonionics, Zwitterionics), surfactants based upon renewable raw materials, environmental effects of surfactants.

Unit-3: Micelle Formation by Surfactants (9 Hours)

Micellar structure and shape, factors affecting the value of the cmc in aqueous media, thermodynamic parameters of micellization.

Unit-4: Reduction of Surface and Interfacial Tension by Surfactants (9 Hours)

Efficiency in surface tension reduction, effectiveness in surface tension reduction, liquid-liquid interfacial tension reduction, dynamic surface tension reduction.

Unit-5: Application of surfactants (9 Hours)

Detergency and Its Modification, Emulsification, Foaming and Antifoaming, Wetting and Its Modification

Books Recommended:

1. Surfactants and interfacial phenomena - Milton J. Rosen
2. Chemical formulation an overview of surfactant – based preparation used in everyday life – Tony Hargreave
3. Industrial chemistry – B. K. Sharma.

SEMESTER II

17VCTGC06	Core 6 : Surface Coating Techniques	3 Hrs/Wk
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Course Outcomes:

On the successful completion of the course, students will be able to:

- Recognise the need and role of surface coating in correlation with its preliminary classification in decorative and protective coatings.
- Understand basic process of electrodeposition to Identify, Select & Understand various inorganic surface coating techniques.
- Design experiment and manipulate involved parameters (factors affecting) for electroplating of chrome, nickel and silver.
- Formulate organic surface coating materials and understand the role of each ingredient.

Unit-1: Basics of Surface coating (8 Hours)

Introduction, preliminary treatment of surfaces, objective of coating (on metal & non-metals), classification of surface coatings (inorganic & organic), fundamentals of oil, fat & wax.

Unit-2: Inorganic surface coating (10 Hours)

Introduction, basic process of electrodeposition, rate of deposition, current efficiency, average coating thickness, deposit thickness distribution, current distribution, throwing power, internal stress, Faraday's Law, Anodic coating, cathodic coatings, hot dipping (galvanising, tinning), metal spraying, cementation, metal cladding, electroplating, anodising, vacuum metallizing, cathode sputtering, electrophoretic coating, surface conversions, vitreous coating, vapour deposition.

Unit-3: Electroplating (9 Hours)

Theory and electroplating techniques of nickel, copper, chrome and silver, chemistry of electrolytes, buffers & additives, types of electrodes, factors affecting electroplating, electroplating of industrial products – 3 examples of each.

Unit-4: Characteristics of electro-deposit & factors affecting quality (8 Hrs)

Thickness, adherence, hardness, brightness, protective value, decorative value, throwing power, temperature, pH of the bath liquid, density, viscosity, GLP, Safety & Hazard, SOP of specific electroplating technique (Systematic Operating Procedures)

Unit-5: Organic surface coating (10 Hours)

Introduction, Classification, Raw Material & their characterization, Formulation, Properties and Applications, Specifications: Oil paints, water paints (emulsion paints), varnishes, lacquers and wax polishes and special paints.

Books Recommended:

1. Engineering chemistry - R. Gopalan, D. Venkappayya, S. Nagarajan.
2. Chemistry in engineering and technology volume -1 & 2 – J.C. Kuriacose & J. Rajaram
3. Engineering chemistry – Jain & Jain
4. Industrial hygiene and chemical safety – M. K. Fulekar.