

GOVERNMENT POLYTECHNIC, BARGARH
DEPARTMENT OF MATHEMATICS & SCIENCE



LESSON PLAN
ENGINEERING CHEMISTRY (THEORY)
FOR
1ST & 2ND SEMESTERS
(BRANCH: COMMON)
(SESSION: 2022 – 23)

PREPARED BY
Gouranga Badhei
Sr. Lecturer in Chemistry

GOVERNMENT POLYTECHNIC BARGARH

VISION

To be a reputed polytechnic institute imparting quality technical education to produce diploma engineers with dynamic personalities and innovative competencies in the state of Odisha.

MISSION

- To offer the best and advanced lab facilities adhering to the curriculum to make future engineers.
- To engage highly qualified and competent faculties to make the student acquire the skillful knowledge required.
- To develop an excellent teaching learning environment leading to create the best institute.

SYLLABUS

NAME OF THE COURSE: ENGINEERING CHEMISTRY			
COURSE CODE	Th 2 (b)	SEMESTER	1 st Sem.
THEORY PERIODS	4 Periods/Week	EXAMINATION	3 Hrs
TOTAL PERIODS	60	CLASS TEST	20 Marks
MAXIMUM MARKS	100	END SEMESTER EXAMINATION	80 Marks

Course Objective:

Engineering Chemistry is concerned with the changes of matters with its environment and an ever-growing subject. So, the aim of teaching Engineering Chemistry in Diploma Courses is to acquaint the students with the basic Chemistry of different materials used in industry and to equip the students with the basic principles of chemical changes taking place in different aspects connected to engineering fields. They also develop the right attitude to cope up with the continuous flow of new technology.

Topic wise distribution of periods

Sl.No	Topics/ Units	Periods
A	Physical Chemistry	22
B	Inorganic Chemistry	08
C	Organic Chemistry	10
D	Industrial Chemistry	20
	TOTAL	60

A. PHYSICAL CHEMISTRY

Chapter 1: Atomic structure: Fundamental particles (electron, proton & neutron Definition, mass and charge). Rutherford's Atomic model (postulates and failure), Atomic mass and mass number, Definition, examples and properties of Isotopes, isobars and isotones. Bohr's Atomic model (Postulates only), Bohr-Bury scheme, Aufbau's principle, Hund's rule, electronic configuration (up to atomic no 30).

Chapter 2: Chemical Bonding: Definition, types (Electrovalent, Covalent and Coordinate bond with examples (formation of NaCl, MgCl₂, H₂, Cl₂, O₂, N₂, H₂O, CH₄, NH₃, NH₄⁺, SO₂).

Chapter 3: Acid base theory: Concept of Arrhenius, Lowry Bronsted and Lewis theory for acid and base with examples (Postulates and limitations only). Neutralization of acid & base. Definition of Salt, Types of salts (Normal, acidic, basic, double, complex and mixed salts, definitions with 2 examples from each).

Chapter 4: Solutions: Definitions of atomic weight, molecular weight, Equivalent weight. Determination of equivalent weight of Acid, Base and Salt.

Modes of expression of the concentrations (Molarity, Normality & Molality) with Simple Problems. pH of solution (definition with simple numerical)

Importance of pH in industry (sugar, textile, paper industries only)

Chapter 5: Electrochemistry: Definition and types (Strong & weak) of Electrolytes with example. Electrolysis (Principle & process) with example of NaCl (fused and aqueous solution).

Faraday's 1st and 2nd law of Electrolysis (Statement, mathematical expression and Simple numerical) Industrial application of Electrolysis- Electroplating (Zinc only).

Chapter 6: Corrosion: Definition of Corrosion, Types of Corrosion- Atmospheric Corrosion, Waterline corrosion. Mechanism of rusting of Iron only. Protection from Corrosion by (i) Alloying and (ii) Galvanization.

B. INORGANIC CHEMISTRY

Chapter 7 : Metallurgy: Definition of Mineral, ores , gangue with example. Distinction between Ores and Minerals. General methods of extraction of metals,

- i) Ore Dressing
- ii) Concentration (Gravity separation, magnetic separation, Froth floatation & leaching)
- iii) Oxidation (Calcinations, Roasting)
- iv) Reduction (Smelting, Definition & examples of flux, slag)
- v) Refining of the metal (Electro refining, & Distillation only)

Chapter 8 : Alloys: Definition of alloy. Types of alloys (Ferro, Non-Ferro & Amalgam) with example. Composition and uses of Brass, Bronze, Alnico, Duralumin

C. ORGANIC CHEMISTRY

Chapter 9 : Hydrocarbons : Saturated and Unsaturated Hydrocarbons (Definition with example) Aliphatic and Aromatic Hydrocarbons (Huckle's rule only). Difference between Aliphatic and aromatic hydrocarbons IUPAC system of nomenclature of Alkane, Alkene, Alkyne, alkyl halide and alcohol (up to 6 carbons) with bond line notation. Uses of some common aromatic compounds (Benzene, Toluene, BHC, Phenol, Naphthalene, Anthracene and Benzoic acid) in daily life.

D. INDUSTRIAL CHEMISTRY

Chapter 10: Water Treatment: Sources of water, Soft water, Hard water, hardness, types of Hardness (temporary or carbonate and permanent or non-carbonate), Removal of hardness by lime soda method (hot lime & cold lime—Principle, process & advantages), Advantages of Hot lime over cold lime process. Organic Ion exchange method (principle, process, and regeneration of exhausted resins)

Chapter 11: Lubricants: Definition of lubricant, Types (solid, liquid and semisolid with examples only) and specific uses of lubricants (Graphite, Oils, Grease), Purpose of lubrication.

Chapter 12: Fuel: Definition and classification of fuel, Definition of calorific value of fuel, Choice of good fuel. Liquid: Diesel, Petrol, and Kerosene --- Composition and uses. Gaseous: Producer gas and Water gas (Composition and uses). Elementary idea about LPG, CNG and coal gas (Composition and uses only).

Chapter 13: Polymer: Definition of Monomer, Polymer, Homo-polymer, Co-polymer and Degree of polymerization. Difference between Thermosetting and Thermoplastic, Composition and uses of Polythene, & Poly-Vinyl Chloride and Bakelite. Definition of Elastomer (Rubber). Natural Rubber (it's draw backs). Vulcanization of Rubber. Advantages of Vulcanized rubber over raw rubber.

Chapter 14: Chemicals in Agriculture: Pesticides: Insecticides, herbicides, fungicides- Examples and uses. Bio Fertilizers: Definition, examples and uses.

Syllabus Coverage up to 1st Internal Examination

Chapter 1,2,3,4,5,6

Course Outcome

After Completion of the Course the Students will be able to:

C102.1: Understand the structure of atoms, chemical bond formation and theories and concentrations of acids and bases.

C102.2: Apply the knowledge of electrolysis in the field of industrial application like galvanization, corrosion prevention and electrolytic extraction of metals.

C102.3: Explain the process of metallurgical operation for the extraction of metals from ores and know the composition of various alloys for their suitable applicability.

C102.4: Understand the classification, nomenclature and structural formula of organic compounds and know the use of aromatic compounds in daily life.

C102.5: Apply various methods of water purification, preparation of various polymers and know the use of lubricants & fuels in industries and chemicals in agricultural fields to enhance the growth and productivity.

LESSON PLAN

Session: 2022 – 23

Course Name : Engineering Chemistry Course Code : Th 2 (b) Semester : 1st & 2nd Semester Periods/Week : 04 Total Periods : 60	Name of the Faculty: Gouranga Badhei, Sr. Lecturer (Chemistry) Session : 2022-23
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Week	Class/Day	Topics to be Covered	Primary Reference
1	1	Fundamental particles (e, p, n): Definition, masses and charges, Rutherford's Atomic model.	T1, T3, R1
	2	Failures of Rutherford's Atomic Model, Atomic No., Mass No. Definition, examples and properties of Isotopes, isobars and isotones.	T1, T3
	3	Bohr's atomic model and Bohr-Bury Scheme	T1, R2
	4	Aufbau principle, Hund's Rule, Electronic configurations (up to At. No. 30)	T1, T3, R2
2	5	Chemical bonding: (Definition and types) :-Ionic bonding and covalent bonding with examples (NaCl and MgCl ₂)	T3, R1
	6	Covalent bonding with examples (H ₂ , Cl ₂ , O ₂ , N ₂ , H ₂ O and CH ₄)	T3, R1, R2
	7	Coordinate bonding with Examples (NH ₄ ⁺ and SO ₂)	T1, T3
	8	Arrhenius theory and its limitations.	T1, T3, R2
3	9	Bronsted –Lowery Theory and its limitations.	T1, T3
	10	Lewis Theory and its Limitations.	T1, R2
	11	Acid –Base Neutralization Reaction, Definition of Salt, Types of salts with examples.	T3, R1
	12	Definition of At. Wt., Mol. Wt. and Eq. wt. Determination of Equivalent weights of Acids, Bases and Salts.	T1, T3, R1
4	13	Molarity and Normality with simple numerical.	T1, T3, R1
	14	Molality- Simple numerical, P ^H – Simple numerical.	T1, T3, R1
	15	Importance of P ^H in industries (Sugar, Textile and Paper Industries)	T1, T3, R1
	16	Electro chemistry: Definition of Electrolyte, types of electrolytes (Strong and Weak)	T3, R2
5	17	Electrolysis- principle and process.	T3, R2
	18	Electrolysis of fused and aqueous NaCl solution.	T3, R2
	19	Faraday's 1 st law of electrolysis, simple numerical.	T3, R2
	20	Faraday's 2 nd law of electrolysis, simple numerical. Industrial applications of electrolysis- Zinc plating.	T3, R2
6	21	Definition of Corrosion, Types of corrosions, Atmospheric corrosion, mechanism of rusting of iron	T1, R2
	22	Waterline corrosion, protection of corrosion – Alloying and Galvanization.	T1, R2
	23	UNIT DISCUSSION	
	24	Metallurgy: Definition of mineral and ore, distinction between mineral and ore, ore dressing,	T2, R1
7	25	Crushing and Grinding, Concentration of ore- Gravity separation method and Magnetic separation method.	T2, T4, R1
	26	Froth floatation method and Leaching.	T2, T3, R1
	27	Oxidation: Calcination and Roasting	T2, T4, R1

	28	Reduction- Smelting, Definition and examples of flux and slag	T2, T4, R1
8	29	Refining of metals: Electro refining and distillation	T2, T4, R1
	30	Alloys: Definition of Alloys, types of Alloys: Ferro, Non-ferro alloys, Amalgam, examples	T2, R2
	31	Composition and uses of Brass, Bronze, Alnico and Duralumin	T2, R2
	32	UNIT DISCUSSION	
9	33	IUPAC System of Nomenclature of Alkanes, Alkenes, Alkynes, Alkyl halides and Alcohols	T2, T4, R1
	34	General rules of IUPAC System – I, General rules of IUPAC System – II	T2, T4, R1
	35	IUPAC Names from structural formula. Bond-line Representations.	T2, T4, R1
	36	Structural formula from IUPAC names. Hydrocarbons: Saturated and unsaturated HC (Definition and examples), Aliphatic and Aromatic HC (Huckel's Rule)	T2, T4, R1
10	37	Distinction between aliphatic and aromatic HC. Uses of some common aromatic HC – Benzene, Toluene, and BHC. Uses of Phenol, Naphthalene, Anthracene and benzoic Acid.	T2, T4, R2
	38	UNIT DISCUSSION	
	39	Water treatment: Sources of water, soft water and Hard water, Hardness of water.	T4, R2
	40	Types of hardness (Temporary & Permanent)	T4, R2
11	41	Removal of Temporary hardness of water.	T4, R2
	42	Cold-Lime Soda and Hot Lime-Soda methods.	T4, R2
	43	Advantages of hot LS process over cold LS process. Organic ion-exchange process- Principle, process and regeneration of exhausted Resin.	T4, R2
	44	Lubricants; Definition and Types (solid, Liquid and semisolid) and examples. Specific uses or lubricants (graphite, oils and Grease), Purpose of lubrication.	T4, R1
12	45	Fuel: Def ⁿ and classification of fuels. Def ⁿ of Calorific value of fuel, Choice of good fuel. Liquid Fuel: Diesel, Petrol, and Kerosene --- Composition and uses.	T4, R1
	46	Gaseous Fuel: Producer gas and Water gas (Composition and uses).	T4, R1
	47	Elementary idea about LPG and CNG (Composition and uses only)	T4, R1
	48	Polymer: Definition of Monomer, Polymer, Homo-polymer, Co-polymer and Degree of polymerization. Difference between Thermosetting and Thermoplastic.	T2, R2
13	49	Composition and uses of Polythene, Poly-Vinyl Chloride and Bakelite. Definition of Elastomer (Rubber). Natural Rubber (it's draw backs)	T2, R2
	50	Vulcanization of Rubber. Advantages of Vulcanized rubber over raw rubber.	T2, R2
	51	Chemicals in Agriculture: Pesticides – Insecticides, herbicides.	T2, R2
	52	Fungicides – Examples and uses. Bio-fertilizers: Definition, Examples and uses.	T2, R2
14	53	UNIT DISCUSSION	-----
	54	Doubt Clearance Class	-----
	55	Doubt Clearance Class	-----
	56	Doubt Clearance Class	-----
15	57	Previous Year's Question Answer Discussion	-----
	58	Previous Year's Question Answer Discussion	-----
	59	Previous Year's Question Answer Discussion	-----
	60	Previous Year's Question Answer Discussion	-----

Course Beyond Syllabus:

Module	Chapter	Topics beyond Syllabus
I	1	<ul style="list-style-type: none">Failures of Bohr's atomic model.Idea about quantum numbers.Pauli's exclusion principle.
	2	<ul style="list-style-type: none">Idea about hydrogen bonding and metallic bonding.
	3	<ul style="list-style-type: none">Application of neutralization reactions in volumetric titrations.
	4	<ul style="list-style-type: none">Mole fraction, ppm, percentage concentration.Importance of pH in water supply, soap industry, agriculture, industrial waste treatment.
	5	<ul style="list-style-type: none">Conductivity of electrolytic solution.Electrotyping.
	6	<ul style="list-style-type: none">Cathodic protection of corrosion.
II	7	<ul style="list-style-type: none">Electrolytic reduction.Self-reduction.Polling, liquation, zone refining, cupellation method of refining of crude metals.
	8	<ul style="list-style-type: none">Unique Properties of alloys.
III	9	<ul style="list-style-type: none">Homologous series.Non-benzenoid aromatics.
IV	10	<ul style="list-style-type: none">Inorganic ion-exchange resins.Volumetric methods to determine total hardness of water.
	11	<ul style="list-style-type: none">Components of grease.
	12	<ul style="list-style-type: none">Renewable and non-renewable fuels.Alternative sources of energy like geothermal energy, energy cropping.
	13	<ul style="list-style-type: none">Addition polymerization and condensation polymerization.Synthetic rubbers like Buna-N, Buna-S.
	14	<ul style="list-style-type: none">Rodenticides,Structural formulae of Gammaxene and DDT.

BOOKS FOR REFERENCE:

TEXTBOOKS

T1: Textbook of Intermediate Chemistry Part-1 Nanda, Das, Sharma, Kalyani Publishers

T2: Textbook of Intermediate Chemistry Part-2 Nanda, Das, Sharma, Kalyani Publishers


T3: Engineering Chemistry by B.K. Sharma, Krishna Prakashan Media Pvt. Ltd


T4: Engineering Chemistry by Y.R. Sharma and P. Mitra, Kalyani Publishers

REFERENCE

R1: Engineering Chemistry for Diploma – Dr. R K Mohapatra, PHI Publication, New Delhi.

R2: Engineering Chemistry- Jain & Jain, Dhanpat Roy and Sons.


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