VEER NARMAD SOUTH GUJARAT UNIVERSITY

F.Y. B.Sc.

Industrial Chemistry (Vocational)

Paper – I

Industrial Aspects of Chemistry

ACADEMIC YEAR : 2006-2007

70 Marks External | **Total 60 Hours**
30 Marks Internal | **Time 3:00 Hours (Uni. Exam.)**

UNIT # I

Chap. 1 Nomenclature:- **(4 Hours)**

Generic Names, trade names, Systematic names of various acids, binary salts, Polyatomic anions etc. IUPAC nomenclature of Hydrocarbons – alkanes, alkenes, alkynes, organic acids, alcohols, ketones, esters, aldehydes, halogenated, amines, nitro compounds.

Chap. 2 Raw Materials for organic compounds : Petroleum:-(8 Hours)

Origin of petroleum, processing of crude petroleum, Natural gas, cracking, Reforming, Hydroforming, isomerisation. Various important chemicals obtained form Methane, Ethane, Propane, Butane, Ethene, Propene, Isobutylene, Benzene & Toluene.

UNIT # II

Chap. 3 Coal:- **(7 Hours)**

Classification, properties, analysis and constitution of coal, secondary fuels and other products derived from coal, properties and uses of coke, coal gas and coke-oven gas, coaltar and distillation of coaltar.

Chap. 4 Renewable natural resources:- **(5 Hours)**

Cellulose, starch properties, modification, important industrial chemicals derived from them alcohol based various chemicals, oxalic acid, furfural.

UNIT # III

Chap. 5 Metallurgy:- **(4 Hours)**

Definition, occurance of metal, Division of metallurgy, Basic metallurgical operations : Dressing of an ore, pulverization, calcinations, Roasting and Refining.

Chap. 6 Physicochemical Principles involved in Extraction of:- **(4 Hours)**

Iron, Copper, Lead, Silver, Sodium, Aluminum, Magnesium, Zinc, Chromium.

Chap. 7 Inorganic Materials of Industrial Importance:- **(4 Hours)**

Availability, Various forms, Structures, Properties, and uses of Alumina, Silica, Silicates, Clays, Mica, Carbon, Zeolites & Felspars.

UNIT # IV

Chap. 8 Catalysis:- (12 Hours)

Introduction, types of catalysis with examples, characteristics of catalytic reaction, promoters, catalytic poisioning, Auto calatysis, negetive calatysis, activation energy and catalysis, The Intermediate compound formation theory, the adsorption theory, acid-base catalysis, Definition mechanism and characteristics of enzyme catalysis introduction to Phase Transfer catalysis, industrial importance of catalytic processes.

UNIT # V

Chap. 9 Surface Chemistry and Interfacial Phenomenon:- (12 Hours)

Adsorption, types of adsorption, Adsorption isothermes, Adsorption of Solute from Solutions, application of adsorption, Ion-exchange adsorption explanation and applications, colloidal dispersion – preparation and optical, Kinetic and electrical properties of Sols, Suspensoids, gels, micells, surfactants, emulsions.

Reference Books:-

1. Introduction to petroleum chemicals, H. Steiner Pergamon Press.
2. From Agrocarbons to petrochemicals , L.F. Hatch and S. Matarm, Gulf Publishing Co., Houston.
3. Cotton – Cellulose Its Chemistry and Technology, Hall A.G.
4. Methods in Carbohydrates Chemistry Vol. 3
5. Cellulose, Whistler R.L.
6. Chemistry of Cellulose , Heuser, E
7. Chemistry and Industry of Starch, Kerr, R. Wurzburg.
8. Modified Starches: Properties and uses, Wurzburg. O.B.
9. Principles of extractive metallurgy, Herbashi, Vol. 1,2.
10. Theory of metallurgical processes, Volsky A. and Sergievskaya, E.
11. Text book of metallurgy Baiky A.R.
12. Theory of metallurgical processes, Fillipove Mir Publication.
13. Clays, H.Ries, John Wileys and Sons.
14. Unit Processes of Extractive Metallurgy, Peblke, Elsevier Publication.
15. Industrial Chemistry Riegel, Reinhold Publication.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

F.Y. B.Sc.

Industrial Chemistry (Vocational)

Paper – II

Fundamentals of Chemical Engineering – I

70 Marks External **Total 60 Hours**
30 Marks Internal **Time 3:00 Hours (Uni. Exam.)**

UNIT # I

Chap. 1 Dimension and Units of Basic Chemical Calculations:- **(6 Hours)**

Atomic weight, equivalent weight , mole, composition of (i) liquid mixtures and (ii) gaseous mixtures .

Chap. 2 Material Balance without Chemical reactions:- **(6 Hours)**

Flow diagram for material balance, simple material balance with or without recycle or by-pass for chemical engineering operations such as distillation, absorption, crystallization, evaporation, extraction etc.

UNIT # II

Chap. 3 Material Balance Involving Chemical Reaction:- **(6 Hours)**

Concepts of limiting Reactant, Conversion, yield, liquid, phase reaction, gas phase reactions with/without recycle or by – pass.

Chap. 4 Energy Balance:- **(6 Hours)**

Heat capacity of pure gases and gaseous mixtures at constant pressures, sensible heat changes in liquids, Enthalpy changes.

UNIT # III

Chap. 5 Fluid Flow:- **(6 Hours)**

Fans, blowers, compressors, vaccum pumps, ejector.

Pumps:- Reprobating pumps, Gear pumps, Centrifugal pumps.

Heat transfer:- Heat exchangers - shell and tube type finned tube heat exchangers, plate heat exchangers, refrigeration - cycles.

Chap. 6 Mixing & Extraction :- **(6 Hours)**

Mixing:- Introduction, Mixing of liquid – liquid, solid – solid, liquid – solid systems.

Extraction:- Introduction , selection of solvents, equipment spray column, packed column, rotating disc column, mixer – settler.

UNIT # IV

Chap. 7 Distillation, Absorption and Evaporation:- **(6 Hours)**

Distillation:- Introduction, Batch & continuous distillation, separation of ,plate columns and packed columns.

Absorption:- Introduction, equipments, packed columns, stray columns, bubble columns, packed bubble columns, mechanically agitated contractors.

Evaporation:- Introduction, equipment – short tube (standard) evaporator, forad circulation – evaporators, falling film evaporators climbing film (upovavd flow) evaporators, wiped (agitated) film evaporator.

Chap. 8 Filtration, Crystallisation & Drying:- (6 Hours)

(a) **Filtration:-** Introduction, filter media & filter aids, equipment – late and frame filter prose, candle filter, bag filter & centrifuge.

(b) **Crystallisation:-** Introduction , solubility, supersaturation nucleation, rate of crystal – growth & **ΔL** Law, equipment for crystallization – tank crystalliser, scared surface crystallisers, circulating - liquid evaporator crystalliser, circulating – magma vaccum crystallizer.

(c) **Drying:-** Introduction, equilibrium moisture content of materials, bound & unbound water in solids, Drying carves, equipment – Tray dryers, Rotary dryers, Flash dryers, Fluidised Bed dryers, Drum dryers, spray dryers,

UNIT # V

Chap. 9 Utilities in Chemical Industries:- (8 Hours)

(a) **Fuels:-** Type of fuels, Advantages & disadvantages, combustion of fuels, calorific value, specifications for fuel oil.

(b) **Boilers:-** Types of Boilers & their functioning. Lancashire Boiler, Cornish Boiler, Vertical Tubler boilers, Benson Boiler, La mont Boiler, Loeffler boiler, volex boiler, Schmidt Hartman Boiler, Ramsin Boiler,

(c) **Water:-** specification for industrial use, various water treatments.

Chap. 10 Air and Steam:- (4 Hours)

(a) Air:- Specifications for industrial use, processing of air, Removal of Particulates, Removal of gaseous & Odorous pollutants, packed tower vs. plate towers.

(b) Steam:- Generator and uses of steam.

► Reference Books:-

(1) Stoichiometry, B.I. Bhatt and S.M. Vora. Tata MC Grow Hill Publishing Company Ltd. New Delhi.

(2) Chemical Process Principles – Part – I, O.A. Hougen, K.M. Watson,R.A. Ragatz. Asia Publishing House, Bombay.

(3) Introduction to chemical engineering, W.L. Badger and J.T. anchero Mc Graw Hill Book Co., New York.

(4) Unit Operations in Chemical Engineering. W.L. Mc Grow and J.C. Smith , Mc Grow Hill Book Co., New York.

(5) Chemical Engineering Hand Book. J.H. Perry, Mc Grow Hill Book Co., New York.

(6) Unit Operations – I and II D.D. Kale. Pune Vidyarthi Griha Prakashan, Pune.

(7) Standard Handbook of Plant Engineering Editors. R.C. Rosaler and J.O. Rise Mc Grow Hill Book Co., New York.

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F.Y. B.Sc.

Industrial Chemistry (Vocational)

Practical

ACADEMIC YEAR : 2006-2007

Total Marks: **70 (Uni. Exam.)** **(4 Hours)**
30 (Internal Evaluation Marks) 20 (Int. Pre. Exam.)
+ 10 (Att. + Emp.)

(I) <u>Organic Spottings:-</u>

Up to functional groups, M.P. / B.P. & recrystallisation,

ACIDS:- Benzoic acid, Salicylic acid, Cinnamic acid, Succinicacid.

BASES:- Aniline, m-nitro aniline, p-Toluidine.

PHENOLS:- Resorcinol, α-naphthol, β-naphthol.

NEUTRALS:- Acetone, Benzaldehyde, Methyl acetate, Methanol, Glucose, Fructose, Benzene, Toluene, p – dichlorobenzene, Chlorobezene, Carbontetra chloride, Urea, Benzamide, m-dinitro benzene.

(Minimum 10 Substance to be given.)

(II) <u>Volumetric Exercises:-</u>

(i) **Preparation of standard solutions:-** primary and standards determination of H_2SO_4 and H_3PO_4 in mixture, standardisation of $Na_2S_2O_3$ by $K_2G_2O_7$ / KIO_3.

(ii) **<u>Volumetric titration of mixtures of Bases versus Acid.</u>**

($NaOH + Na_2Co_3$) → 0.1N Hcl.

($Na_2CO_3 + NaHCO_3$) → 0.1N H_2SO_4

(iii) **<u>ORE ANLYSIS:-</u>** Dolomite lime stone, calcite analysis of alloys such as cupro-nickel

(III) <u>Simple laboratory techniques:-</u>

(i) Fractional distillation, traditional crystallisation, Boiling point diagram.

(ii) **<u>Chromatography:-</u>** Colomn, paper and thin layer.

(IV) Physical Exercise (Extraction Process):-

(i) Phase diagram

(ii) partition coefficient.

(V) Acquaintance with safety measure in a laboratory, hazards of Chemicals.

(VI) Study experiments/demonstration experiments.

Reference Books:-

1. Vogel's Text book of Quantitative Chemical Analysis (Raised by G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney) 5th Edition ELBS. Longman.

2. Text Book of Macro & Semimicro Qualitative Inorganic Analysis by Vogel, Swehla. G.