



STRUCTURE FOR DIPLOMA CHEMICAL ENGG. PROGRAMME

SN	Sub Code	Sub.	L	P	T	Exam Scheme				
						Ext	Ss	Pr	Tw	Tot

Semester – I

1	1DCH01	Maths - I	3	-	1	60	40	*	*	100
2	1DCH02	Commu.Skill	3	-	1	60	40	*	*	100
3	1DCH03	Appl.Chem.	3	3	1	60	40	50	25	175
4	1DCH04	Engg.Mesr.	-	3	-	*	*	50	25	75
5	1DCH05	Comp.Appli.	-	3	1	*	*	50	25	75
6	1DCH06	EMEE	3	-	1	60	40	*	*	100

Semester- II

1	2DCH01	Maths - II	3	-	1	60	40	*	*	100
2	2DCH02	Org.Chem.	3	3	1	60	40	50	25	175
3	2DCH03	Phy.Chem.	3	3	1	60	40	50	25	175
4	2DCH04	C.E. Materials	3	-	1	60	40	*	*	100
5	2DCH05	Engg.Graphics	3	3	1	60	40	*	50	150
6	2DCH06	W.S.	-	2	-	*	*	*	50	50

Semester – III

1	3DCH01	Mech.Op	3	3	1	60	40	50	25	175
2	3DCH02	C.P.I	3	3	1	60	40	50	25	175
3	3DCH03	Ind. Saf & Env.Engg.	3	3	1	60	40	50	25	175
4	3DCH04	Enr Engg & Plant Uti.	3	-	1	60	40	*	*	100
5	3DCH05	P.D.M.&Eco.	3	-	1	60	40	*	*	100
6	3DCH06	Yoga	-	2	-	-	-	50	-	50

Semester – IV

1	4DCH01	H.T.	3	3	1	60	40	50	25	175
2	4DCH02	FFO	3	3	1	60	40	50	25	175
3	4DCH03	P.Cl.	3	-	1	60	40	-	-	100
4	4DCH04	M.T.I	3	3	1	60	40	50	25	175
5	4DCH05	Instru.	3	-	1	60	40	*	*	100
6	4DCH06	C.E.Eq.Drg.	-	3	1	*	*	50	25	75

Semester - V

1	5DCH01	M.T.II	3	3	1	60	40	50	25	175
2	5DCH02	Ele.of Ther & RE	3	-	1	60	40	*	*	100
3	5DCH03	P.R.P.T.	3	3	1	60	40	50	25	175
4	5DCH04	F.T.	3	3	1	60	40	50	25	175
5	5DCH05	Dyes& Int.Tech/PolyTech	3	-	1	60	40	*	*	100

Semester – VI

1	6DCH01	Ind.Trng	-	-	-	*	*	100	50	150
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1DCH01: MATHEMATICS –I

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
Lecture	Pr	Tutorial	Th	sess	Pr	Tw	Total
3	---	1	60	40	---	---	100

➤ PART-I : ALGEBRA

1. **Indices and Surds: (4 hr.)**
Concepts, examples of indices, square roots of surds, simple example on surds, example on surds, examples on square root of surds.
2. **Logarithm: (2 hr.)**
Concepts, logarithm rules, examples based on rules and calculation (without log-table)
3. **Arithmetic and geometrical progression : (4 hr.)**
Sequences, sum of n^{th} terms of an arithmetic progression by formula, arithmetic mean, computation of n^{th} term of a geometric progression, geometrical mean, examples.
4. **Binomial theorem: (4 hr.)**
Meaning of factorial, permutation, combination, binomial expansion, finding constant term and co-efficient of x^r , examples of finding any terms.
5. **Matrices: (5 hr.)**
Determinant, definition of matrix of order $m \times n$, types of matrix, algebraic operations on matrices, examples to solve linear simultaneous equations of two or three variables.
6. **Vector algebra: (5 hr.)**
Concept of vector and scalar, types of vectors, algebraic operations on vectors, magnitude and direction of vectors, geometrical representation of vectors.

➤ PART-II : TRIGONOMETRY

1. **Measurement of angles: (1 hr.)**
Angles in degree and radians, arc length, area of sector.
2. **Trigonometric ratios: (2 hr.)**
Definition and identities, examples on trigonometric ratios
3. **Standard, Compound and Multiple angles: (7 hr.)**
Concepts, Addition and subtraction formula, Formula for multiple and sub multiple angles, examples.
4. **Periodic functions and graphs: (3 hr.)**
Definition and concept of periodic functions, graphs of sine and cosine.
5. **Inverse trigonometric function: (1 hr.)**
Definition and simple examples.
6. **Properties and solutions of triangle: (3 hr.)**
Sine and cosine rules, projection formulae, Napiear's formula, area of triangle by using different formulae, solution of triangle.

7. Height and distances: (1 hr.)

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Examples.

TEXT BOOK :

1. Polytechnic Mathematics – I

by Dr. N. R. Pandya (Mahajan publishing house, Ahmedabad)

REFERENCE BOOK:

1. Polytechnic Mathematics – I

by Prof. R. P. Rethaliya (Nirav and Roopal prakashan, Ahmedabad)

2. Diploma Engineering Mathematics – I

by B. M. Patel, Dr. Ajay V. Shah, Mehul B. Patel (Nirali prakashan, Mumbai)

3. Polytechnic Mathematics Vol. I – TTTI, Bhopal.

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1DCH02: Communication Skills

Teaching Scheme			Exam Scheme				
L	Pr.	T	Th.	Sess.	Pr.	Tu.	Total
3	-	1	60	40	-	-	100

(Total classroom work 30 hours which excludes tutorials)

Topics:

No. of hrs

1. Introduction to the importance of the English Language. [1]
2. Introduction to the importance of the Communication Skills. [1]
3. English vocabulary improvement. [1]
4. English grammar updating [4]
 - i. Articles and Prepositions
 - ii. Prefixes and Suffixes
 - iii. Sentence formation
5. Spoken English improvement [3]
 - i. IPA
 - ii. Pronunciation
 - iii. Fluency
6. Oral Communication [5]
 - i. Speech improvement
 - ii. Elocution
 - iii. GD and Self Presentation
7. Written Communication [5]
 - i. Developing the paragraph
 - ii. Essays
 - iii. Comprehensions
8. Letter Writing [5]
 - i. Personal letter
 - ii. Application letter
 - iii. Complain and Request letters
9. Developing the given story and idea [3]
 - i. Oral form
 - ii. Written form
10. Presentations- PowerPoint and Multimedia [3]

Source: Classroom learning and teaching activities will be supplemented by the material Prepared by the faculty, which will be evaluated in the examinations.

1DCH03: APPLIED CHEMISTRY

Teaching Scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Basic Concept (4 Hour)

Matter, elements, compounds, atoms, molecules, molecular formula, mole concept, Avogadro's number, gram-atomic weight, gram-molecular weight, equivalent weight, STP, Avogadro's hypothesis and its application, derivation of general gas equation $PV=nRT$, Dalton's law of partial pressure,

2. Atomic structure (7 Hour)

Thomson's model its limitation, Rutherford's model and its limitation, Brief introduction to Bohr's model and its limitation, Concept of shells and subshells, Dual nature of matter and light, De-broglie relationship, Heisenberg uncertainty principle, Modern concept of atomic structure, atomic number, mass number, orbital concept, quantum numbers, shape of orbital, electron configuration of elements using Auf-bau principle, Hund's rule and Pauli's exclusion principle, isotopes, isobars.

3. Modern periodic table (4 Hour)

Brief introduction to Mandeleev's periodic table and its drawback, Classification of element on the basis of their electronic configuration, periodic trend of ionization energy, electron affinity and electron negativity of elements in periodic table

4. Chemical Bonding (6 Hour)

Ionic bonds, co-valent bonds, co-ordinate co-valent bonds, H-bonds, valence, electronic theory of valence, Dot & Lewis formula of elements, Valence bond theory (VBT) and geometry of some simple molecules having hybridization of sp^3 , sp^2 , sp , Valence shell electron repulsion pair theory (VSEPR) with shape of some simple molecules like BeF_2 , BF_3 , CH_4 , PCl_5 , Molecular Orbital Theory (MOT) of homo nuclear diatomic molecules like H_2 , He_2 , O_2 , N_2 .

5. Chemical equilibrium (5 Hour)

Reversible & irreversible reaction, rate of reaction, law of mass action, equilibrium state, equilibrium constant K_e for homogeneous and heterogeneous systems, relationship between K_e and K_p , Le-Chatelier principle and its application

6. Ionic equilibrium (5 Hour)

Ionisation of strong and weak electrolytes in water, ionic equilibrium, acid and base theories, dissociation constant of weak acid, K_a , weak base K_b and K_{sp} Self ionization of water K_w , pH scale, determination of pH of solution from its strength, buffer solutions, Common ion effect with illustrative example

7. Solutions (4 Hour)

Types of solutions, different methods of expressing strength of solutions, viz. molarity, molality, normality, formality, weight percent, preparation of standard solutions, Vapour pressure and Rault's law, ideal and non ideal solution, positive and negative deviation of non ideal solution from Rault's law

8. Water and its treatment (5 Hour)

Sources of water, hard and soft water, kinds of hardness, effect of hardness, removal of hardness of water by soda-lime, permutite and ion-exchange process.

Text Book:

Essential of Physical chemistry –Arun Bahl, B.S. Bahl, G.D. Tuli

Reference :

General Chemistry- V P Mehta

General Chemistry -T.T.T.I Bhopal

Chemistry Foundations - David E Goldberg

Applied Chemistry - Dr. A S Patel, Dr. K M Shah,

Chemistry the central science - Theodore L Brown, H. Eugene Leney

1DCH04 ENGINEERING MEASUREMENTS

TEACHING SCHEME			EXAMINATION SCHEME		
L	P	T	Practical	Term work	Total Marks
--	03	--	Marks	Marks	
			50	25	75

Laboratory Experiments:

- 1 Introduction to Physical Quantities and Units
- 2 Linear Measurements
Length & Diameter by Scale, inside- out side callipers
- 3 Precision Measurements
Length & Diameter by Vernier callipers, Micrometer screw, Depth gauge
- 4 Measurement of Area
Regular & Irregular shapes
- 5 Measurement of Electrical Energy
- 6 Measurement of frictional coefficient
- 7 Measurement of volumetric flow rate & Mass flow rate
- 8 Measurement of pH
- 9 Measurement of hardness of water
10. Measurement of Specific Gravity
- 11 Measurement of Viscosity

N.B.: Sr.No.1 to 6 will be conducted by Mech. Engg. Department while rest will be by Chemistry department.

1DCH 05: COMPUTER APPLICATION

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
-	3	1	-	-	50	25	75

Laboratory experiments

- ⇒ Introduction to computer system and software
- ⇒ Introduction to operating system ,file identification, bytes, directory
- ⇒ Introduction to word processing, data entry, save, quit,
- ⇒ Basic setting like left and right margin, footnotes, headers, justification, tabulation
- ⇒ Editing text using detailing character, word lime, search, replace directory
- ⇒ Cut\paste, move, copy, sort, file read, file write
- ⇒ Mail merge, print, index, book mark, tables of content
- ⇒ Introduction to worksheet, workbook, cell, row, column, data entry, open, save, quit, help
- ⇒ Editing data, clean, insert, delete cell, row, column
- ⇒ Work sheet settings, width of column, color, heading, wide and display, align data, bold, italics, orientation
- ⇒ Freeze rows, columns split sort, legend
- ⇒ Chart 3 D drawings
- ⇒ Multiple worksheets, copy, move, linking data between worksheets
- ⇒ Prepare worksheet to print, page break
- ⇒ Discipline wise Engineering Application

Text book: -

MS office instant Reference
Windows inside - Peter Norton
Teach yourself windows
Dos instant Reference

1DCH06 ELEMENTS OF MECHANICAL AND ELECTRICAL ENGINEERING

TEACHING SCHEME			EXAMINATION SCHEME					
L	P	T	Theory		Sessional		Term work	Total Marks
			Hrs.	Marks	Hrs.	Marks	Marks	
03	--	1	03	60	1	40	--	100

1 Power transmission & Safety

Introduction to power transmission, Modes of power transmission, Belt drives, Rope drives, Gear drives, Chain drive system, Causes of accidents & their remedies.

2 Boilers

Definition, Function, Classification, working principles of Babcock & Wilcox boiler & Cochran

Boiler, Introduction to Boiler mountings & accessories, Different types of mountings & accessories- their application & working principle.

3 Prime movers

Introduction, Function, Classification of prime mover, Working principle of Internal combustion

engines, Four stroke (Petrol & Diesel) Two stroke(Petrol & Diesel), Introduction to Recent trends

eg. MPFI(Multi Point Fuel Injection), DTS-I (Digital Twin System. Ignition)

4 Welding

Introduction to metal joining processes, Classification, Definition of Welding, Classification of

welding, Arc welding: definition, working principle, types, equipments, electrode codification; Gas

welding : definition, working principle, types, equipments, Types of welding flames, Flux, Brazing,

Soldering, Safety precaution during welding process.

5 Material Handling

Introduction, Classification of material handling equipments, Factors affecting the selection of

MHE, hoisting equipments, conveying equipments, Selection of suitable material handling

equipments for the given situation.

6 Fundamentals of Electrical engineering

Modern electron theory, Basic electrical quantities(Current, Voltage, Resistance etc), Ohm's law,

Farade's law of Electromagnetic Induction.

7 A.C. and D.C. Circuits

Introduction to electrical circuits, Fundamentals of A.C./ D.C. Circuits, Parallel and Series

Connections, Examples, Star and Delta connection, Examples.

8 Electrical Machines

Motor, Generator, Transformer- Introduction, working principles, construction, Application,

Specifications.

9 Electrical Appliances

Introduction, External connections of Electrical appliances (Single phase energy meter, A' meter,

Voltmeter, Fan, Fluorescent tube.)

TEXT BOOKS:

- 1 Elements of Mechanical and Electrical Engineering By Atul Prakashan
- 2 Basic Electrical, Electronics and Computer Engineering By R.Muthusubramanian
- 3 Welding Technology By O.P.Khanna
- 4 Work Sop technology By Hajara Chaudhry
- 5 Elements of Heat Engine By R.C.Patel
- 6 Internal combustion engine By Mathur & Sharma

2DCH 01: MATHEMATICS –II

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
Lecture	Pr	Tutorial	Th	sess	Pr	Tw	Total
3	---	1	60	40	---	---	100

➤ **PART-I : CO-ORDINATE GEOMETRY**

1. Point: (3 hr.)

Distance formula, circum centre and in centre of triangle, area of triangle, division of line segment, locus of a point.

2. Straight line: (3 hr.)

Different types of equation of straight line, slope, intercepts, equation of straight line passing through two points or slope and one point, parallel and perpendicular straight lines, angle between two lines.

3. Circle: (3 hr.)

Definition , equations of circle, equation of tangent and normal

➤ **PART-II : CALCULUS**

1. Function and limit: (5 hr.)

Definition, concept and rules, examples

2. Differentiation: (13 hr.)

Definition, formula for x^n , a^x , e^x , $\sin x$ etc., formula for addition, subtraction, product and division of functions, chain rule, derivation of parametric and implicit functions, higher order differentiation, application of derivative(velocity, acceleration, maxima-minima, radius of curvature).

3. Integration: (15 hr.)

Concept, simple basic rules and formulae of integration, indefinite and definite integrals, integration by substitution, examples, application of integration.(area, volume)

TEXT BOOK :

1. Polytechnic Mathematics – II

by Dr. N. R. Pandya (Mahajan publishing house, Ahmedabad)

REFERENCE BOOK:

1. Polytechnic Mathematics – II

by Prof. R. P. Rethaliya (Nirav and Roopal prakashan, Ahmedabad)

2. Diploma Engineering Mathematics – II

by B. M. Patel, Dr. Ajay V. Shah, Mehul B. Patel (Nirali prakashan, Mumbai)

2. Polytechnic Mathematics Vol. II– TTTI, Bhopal.

2DCH 02: ENGINEERING ORGANIC CHEMISTRY

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Purification of organic compounds

Purification of organic compounds by crystallization, distillation, sublimation

2. Detection and estimation

Detection and estimation of C, H, N, O, S and halogens

3. IUPAC Nomenclature

IUPAC Nomenclature of aliphatic, aromatic and hetero-cyclic compounds

4. Stereo-chemistry

Stereo isomerism, optical isomerism, geometrical isomerism, Walden-Inversion

5. Study of Aliphatic compounds

Study of chemical reaction involving & IUPAC Nomenclature involving in important methods of preparation and chemical properties of following compounds with their uses.

Ethane, ethylene, acetylene, ethyl chloride, ethanol, acetaldehyde, acetone, chloroform, acetic acid, ethyl acetate, diethyl ether. Ethylamine, Granger reagent

6. Coal-tar

Fractional distillation and production of coal tar, isolation of its components

7. Study of Aromatic compound.

Study of Aromatic compound & chemical reaction involving in important methods of preparation and their chemical properties of following aromatic compounds. Benzene, toluene, benzene halides, styrene, nitro-benzene, sulphonic acids, aniline, phenol, benzaldehyde, benzoic acid, salicylic acid

8. Orientation

Electronic theory of orientation of benzene substitution reactions

9. Carbohydrates

Classification of carbohydrates, brief information with their structural formula

10. Polymers

Types of polymers, Illustration with their monomers and polymers

Text books

Fundamental Organic Chemistry - P L Soni

Text book of Organic Chemistry - B S Bal & Arun Bhal

Basic concept of Organic Chemistry - Kice & Mar well

2DCH03 PHYSICAL CHEMISTRY

Teaching Scheme (Hr/W)			Exam Scheme (Marks)				
L	Pr	T	Th.	Sess.	Pr.	Tw.	Total
3	2	1	60	40	50	25	175

1. Chemical Kinetics.

Rate of Reaction, Rate law, Order of reaction, Molecularity of reaction, Derivation of rate constant for first and second order reaction, Zero order and Pseudo order reaction, half life period, methods for determination of order of reaction, Theories of rate of reaction, effect of various parameters of rate of reaction, Catalyst and Catalysis, types of catalyst.

2. Colloids.

Basic term with definition, Classification of colloids, types of colloids, methods of preparation & purification of colloids, properties of colloids, Emulsion and Gel with its types, application of colloids.

3. Electrochemistry.

Basic term involved in electrochemistry, Electrodes and its types, Buffer solution & its types, Buffer capacity, Buffer range, Indicators and indicator range, Detail of instrumental methods of titration i.e. Potentiometric, Conductometric, pH-metric methods.

4. Surface Chemistry.

Adsorption and Absorption, Adsorption of Gases, Types of adsorption, Adsorption isotherms, Freundlich's and Langmuir adsorption isotherms, Gibb's equation, Chromatographic and Ion exchange adsorption. Effect of different parameters on Adsorption.

5. Phase Rule.

Definition and statement of Phase Rule and term involved in it, one component system i.e. Water system and Sulphur System in detail with its Phase diagrams.

6. Distribution Law.

Nernst's Distribution law, Solution and solubility, solubility and absorption coefficients (α and β), effect of various parameters on absorption, type of binary solutions, application of distribution law and ratio.

Text Books.

1. Essentials of Physical Chemistry.
By – B. S. Bahl. & G. D. Tuli.
S. Chand & Co. New Delhi.
2. Elements of physical Chemistry.
By – S. Glasstone, Macmalin & co. Ltd. London.

2DCH 04: CHEMICAL ENGINEERING MATERIAL

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	-	1	60	40	-	-	100

1. Introduction & properties of material:

General principles of selection of materials. Definition & explanation of melting point, boiling point, specific heat, thermal conductivity, thermal expansion, thermal insulation, stresses, strain.

2. Corrosion:

Definition, mechanism of corrosion, types of corrosion, dry & wet corrosion, direct corrosion, electro-chemical corrosion, galvanic corrosion, high-temperature corrosion, atmospheric corrosion. Factors affecting/influencing corrosion rate, brief description, different methods for corrosion control and prevention.

3. Metals:

General comparison of ferrous, non-ferrous & alloys. Properties of metals Cast iron, wrought iron, steel, Aluminum, zinc, chromium, nickel, tin, titanium, tungsten, platinum, silver, lead. Properties of alloy duraumin, Y-alloy, brass, bronze, inconel, inovor, hastalloy, alloy steel. Types of furnaces for metal purification, blast furnace, arc furnace.

4. Ceramic materials:

Definition of ceramic materials. Clay-chemical composition china clay, fire clay, bentonite. Refractories- definition, properties & classification of refractories. Bricks-manufacture, properties, uses & types of bricks. Glasses- definition, raw materials used & their effect on glass product, manufacture of glass in brief, types of glass, their properties & uses, soda lime, borosilicate, high silica, fiber, wool & foam glass. Porcelain- properties, composition & uses.

5. Inorganic and other materials:

Polymers & their structure, addition & condensation polymerization. Plastic-definition, properties & classification. Rubber/Elastomers- definition, classification, sources, properties & uses of natural and synthetic rubber, vulcanization. Wood-properties, seasoning types, its advantages & limitations

6. Coatings:

Protective coatings, Metallic coating, chemical conversion coating, organic coating, ceramic coating, Paints-classification, ingredients of paints, their properties and importance, special types of paints & their application. Varnishes- definition, ingredients & classification.

7. Materials for special application:

Lubricants- definition, importance, types, properties & application, method of applying lubricants. Insulation- definition, types of insulating materials, electrical, thermal & sound insulation. Adhesive- definition, classification, advantages & limitations, mechanism of their effect on surface.

Textbooks:

1. Material science processes -S.K.Hazarachaudhary
2. Engineering Materials - S.C.Rangwala
3. Engineering Materials -Patel & Khakkhar

Reference :

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1. Engineering Materials Hand book -Mc. Graw hill Publi.
2. Chemical Engineering Materials - F. Rumford.

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2DCH 05 ENGINEERING GRAPHICS

TEACHING SCHEME			EXAMINATION SCHEME					
L	P	T	Theory		Sessional		Term work	Total Marks
			Hrs.	Marks	Hrs.	Marks	Marks	
03	03	1	04	60	1.5	40	50	150

(1) Drawing equipments, material & their uses

(2) Planning & Layouts of the Drawing

(3) Lines, Letters and dimensioning

(4) Plane geometrical drawing :-

Simple geometrical construction such as construction of plain figure, drawing of arcs and other construction.

(5) Plane geometry :-

Construction of curves used in engineering such as Conics(Ellipse, Parabola, Hyperbola) Cycloidal curves (Cycloid, Epi-cycloid, Hypocycloid), Involutives, Archimedean spirals.

(6) Solid geometry :-

Projection of points, Projection of lines (without H.P & V.P) Projection of planes, Projection of right and regular solids (Prism, Pyramids, Cylinder and Cones)

(7) Orthographic projection :-

Conversion of pictorial views into orthographic projection with section, type of sections-Full section, Half section, interpretation of orthographic views.

(8) Isometric projection :-

Conversion of orthographic views in to isometric projection & views.

(9) Machine parts :-

Types of threads, Bolts & Nuts, Locking devices for Nuts, Rod connections (cotter joints & knuckle joint, shaft couplings, bearings, welded joints.

(10) Graphs and Charts

Concept of representation of data on graphs & Charts

(11) Conventional representation for pipe fittings & piping layout

(12) Computer Aided Drawing & Drafting (CADD)

Introduction, Benefits of CADD, Software for CADD(Auto CAD R 2006), Basics of AutoCAD command(2D), Drafting of drawings

PRACTICAL/TERM WORK :

Preparation of Drawing sheets on following topics :-

- | | | |
|---|--|-------------|
| 1 | Lines, Letters & Dimensioning | : One Sheet |
| 2 | Engineering curves | : One Sheet |
| 3 | Conversion of orthographic to isometric view | : One Sheet |
| 4 | Projection of Lines, Planes & Solids | : One Sheet |
| 5 | Conversion of view isometric view to orthographic view | : One Sheet |
| 6 | Machine Parts & Piping symbols | : One Sheet |
| 7 | Drawing practice on AutoCAD | |

TEXT BOOKS :

- | | | |
|---|------------------------------------|-------------------|
| 1 | Engineering Drawing | By N.D.Bhatt |
| 2 | Engineering Drawing vol . I & II | By P.J.Shah |
| 3 | Engineering Drawing | By Atul Prakashan |
| 4 | A Text Book of Geometrical Drawing | By P.S.Gill |

REFERENCE BOOK :

- 1 Fundamentals of Engineering Drawing
- 2 A Text Book of Machine Drawing

By Luzadder
By P.S.Gill

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2DCH 06: WORK SHOP

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
--	2	--	--	--	50	50	100

1. INTRODUCTION TO WORK-SHOP

Work-shop layout, Importance of various sections/shops of workshop, Type of jobs done in each shop, General safety rules and work-procedure of work-shop.

2. FITTING

Fitting tools like – files, vice, chisels, panch, scriber, hammers, surface plate, try square, calipers etc., fitting operations such as chipping, filling, scraping, grinding, sawing, marking, drilling, reaming, tapping, safety precaution, Demonstration of various operations, Preparation of male-female joints.

3. SMITHY

Smithy tool like - hammer, tongs, Anvil, flattener etc., Smithy operations such as upsetting, drawing down, bending, setting down, for welding, cutting, punching and fullering etc., Safety precautions, Demonstration of various smithy operations.

4. TIN SMITHY

Tin smith tools like – hammers, stakes, scissors etc., sheet metal operations such as shearing, bending, joining, safety precautions, demonstration of various operations.

5. CARPENTARY

Carpentry tools like – saw, planner, chisels, hammers, pallet, marking gauge, vice, tee square, rule etc., carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, type of woods and carpentry hardware, safety precaution, demonstration of various operations by using hardware.

6. PIPE FITTING

Pipe fitting tools, pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling etc., types of various spanners such as flat, fix, ring, box, adjustable etc., safety precautions, demonstration of various operations.

7. METAL JOINING

Metal joining hand tools and equipments, permanent and temporary methods for metal joining such as screw, nuts bolts and washers, rivets, keys, pins and welding soldering brazing, demonstration of metal joining operations, safety precaution.

8. TURNING

Turning operations such as facing, centering and turning, demonstration of different lath parts and demonstration of above operations.

9. MAINTENANCE

Demonstration of dismantling, overhauling, aligning and assembling of pump and motors, demonstration of disassembly, overhauling and assembly of motor, alignment of pump and motor

References :

1. Workshop Familiarization – E. Wilkinson
- 2 Workshop Technology – I – Hazra and Choudhay

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3DCH 01 : MECHANICAL OPERATION

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Introduction of Mechanical Operation

Definition of Unit Operation and Unit Process, Difference between Unit operation and Unit Process, Examples of Unit Operation & Unit Process.

2. Properties of particulate solids

Specific properties of solids, Density & Bulk density. Definition and calculation of particle diameter, Sphericity, equivalent diameter, specific surface area, volume surface mean diameter, mass mean diameter, shape factor, Calculation of no. of particles.

3. Screen Analysis

Need of screen analysis, Types of screen analysis, Application of screen analysis, Types of screens, trommel, grizzlies, Vibrating screen etc. Ideal & actual screen, Capacity & effectiveness of screen (With derivation). Calculation of capacity and effectiveness of screen, faults in screening.

4. Size Reduction

Definition and need of size reduction, Principles of size reduction, characteristics of comminuted products, Energy & power requirements in comminution, laws of size reduction, work index, Types of size reduction equipment with their principle, construction & working, derivation of equation of angle of nip and critical speed. Calculation of angle of nip, capacity & Ribbon factors. Open & close circuit grinding.

5. Sedimentation

Definition of sedimentation, theory of bath sedimentation, Interphase height and time curve, Flocculation principle, Gravity thickener. Explanation of free and hindered settling, cyclone separator, efficiency of cyclone separator. Definition of Stoke's law and Newton's law for terminal settling velocity.

6. Filtration

Definition and applications of filtration, Equipments for liquid – solid separation., Filter press, Rotary vacuum filter, filter media and its required characteristics, filter aids and method of application, calculation of special cake resistance, filter media resistance, porosity for constant rate, constant pressure system and vacuum drum, constant rate filtration and constant pressure filtration, classification of centrifugal equipment, batch centrifuge, Advantages and disadvantages of centrifuge over filter press.

7. Agitation and Mixing

Classification of Impellers, vortex formation and swirling, methods of vortex prevention, factors affecting agitation, Purpose of mixing solids and paste, Principle construction & working of Ribbon blender, Muller mixer, Banbury mixer & Kneaders.

Text Books:

1. Unit Operation in Chem. Engg. - McCabe & Smith
2. Introduction to Chemical Engg.- Badger & Banchero.

Reference:

1. Chemical Engineering Vol. I - Coulson & Richardson

3DCH2 : CHEMICAL PROCESS INDUSTRIES

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

- 1. Introduction:**
General Survey of Chemical Industries, Importance contribution to human life & classification of chemical industries.
- 2. Fuels :**
Classification of fuels, Fuel gases.
- 3. Chlor-Alkali Industry:**
Manufacture of Soda ash, Caustic Soda, Chlorine & Hydrogen
- 4. Cement Industries**
Types of cement, classification of cement, manufacturing of cement & major engineering problems of cement industries.
- 5. Marine chemicals**
Chemicals from seawater, manufacture of common salt and. bromine.
- 6. Oil & Fats Industries**
Classification of oil & fats, Extraction of veg.oil, Hydrogenation of oil, manufacture of soap and glycerine, major Engg. Problems of all such industries.
- 7. Carbohydrate Industries**
Manufacture of sugar and starches. Ethanol from molasses by fermentation, major engg. Problems.
- 8. Pulp and Paper Industries**
Methods of pulp production, manufacture of pulp by Kraft process, recovery of chemicals from black liquor & major engg.problems.
- 9. Pharmaceuticals**
Classification of drugs, manufacture of penicillin and aspirin.
- 10. Pesticides**
Classification of pesticides, manufacture of parathion, 2-4-D, BHC.
- 11. Dyes & Intermediates**
Classification of dyes, manufacture of H-acid and B-naphtha.
- 12. Electrochemical Industries**
Types of electrochemical Indus., electroplating and refining of Aluminum.

Text book:

1. Dryden's outlines of chemical technology, 2nd Edition
M. Gopala Rao, Marshall sittig, East West press private limited, New Delhi.

References :

1. Chemical process industries – Shreve and Joseph.
2. Cchemical process industries - George f. Austin, Mc.Graw Hill International Edition.
3. Industrial chemicals – Faith, Keyes & Clarke.

3DCH03 INDUSTRIAL SAFETY & ENVIRONMENTAL ENGG.

Teaching Scheme (Hr/W)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. General Introduction & Concept of Safety

Safety of organization industrial plant lay out of safety, Safety measures Concept & Importance of safety in chemical industries.

2. Chemical & Fire Hazards & their Control

Definition, sources & classification of hazards like chemical, fire, Different methods for controlling chemical & fire hazards, Objective & importance of fire prevention, fire extinguishing agents & devices with their working.

3. Other hazards & occupational diseases

Concept of mechanical, electrical & Noise hazards with their precautions.& Notified dangerous occupational diseases with their cause and their prevention

4. Personal Protective Devices

Protective devices for head, ears, eyes, face, respiratory system, hand ,feet etc.

5. Introduction to pollution :

Introduction to environmental pollution, sources of pollutants, effects of pollution on human health, vegetation , animal life & effect on environment.

6. Air Pollution :

Sources & Types of air pollutant, classification, properties of air pollutant, effect of air pollution, Air pollution control methods like gravitational settling, Diffusion, Electrostatic precipitation, Centrifugal impaction, Direct interception etc. Air pollution controlling equipments like gravity settler, cyclone separator, fabric filter, electrostatic precipitator, wet scrubber etc.

7. Water pollution :

Introduction, characterization of water, BOD, COD, VM, SM, classification of sources. Water pollution, sewage treatment processes like primary, secondary of final treatment, Brief idea about CETP of design criteria for Industrial effluent treatment plant.

8. Solid waste of disposal methods :

Sources of classification, Methods of disposal like dumping, sanitary land filling, incineration, composting etc.

9 Miscellaneous Pollution :

Sources types of effect of noise pollution, radiation etc.

Text Books:

1. Environmental Pollution control engineering - C. S. Rao

Reference:

- 1) Fundamentals of air & water pollution - P. C. Mishra
- 2) Pollution Control in process Industries - S. P. Mahajan TMH Publication
- 3) Industrial safety health – David. L. Goetsch
- 4) Chemical process safety, fundamentals with applications – Danieal A. Crowel & Joseph. F.
- 5) Safety management – John V. Grimaldi.

Laboratory work:-

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3DCH04 PLANT UTILITIES & ENERGY ENGINEERING

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	-	1	60	40	-	-	100

1. Introduction

Types of energy, energy crisis, Renewable sources of energy, conventional & Non Conventional sources of energy, energy conservation.

2. Conventional fuels

Classification, types, sources, properties, uses, storage, handling & selection factors of various conventional fuels in the form of

- Solid : Coal, Lignite, Coke
- Liquid : Gasoline, Kerosene, Naphtha, Fuel oil, Diesel
- Gaseous : N.G., Refinery gas, Water gas, Producer gas, Coke oven gas, LPG, Oil gas, Industrial Gases etc.

3. Non-conventional sources of energy

Solar energy : Solar radiation, collectors, storage & applications

Wind energy : Introduction, nature of wind & wind farm

Biomass energy : Introduction, Biomass conversion technology by wet & Dry process

Geothermal energy: Introduction & Sources of geothermal energy.

Nuclear energy : Introduction, Nuclear Fuels & Nuclear reactions, types of Propellant & moderators

4. Water & Steam

Importance, Consumption & source of water, water analysis, types of hardness, methods of softening of water like lime soda, zeolite, ion exchange methods etc., Purification of water by screening, sedimentation, coagulation, filtration & sterilization, treatment for boiler feed water, Reuse & Recycling of process water, definition of enthalpy, wet steam, superheated steam, specific volume, Types-classification & comparison of steam generators, Factors affecting the selection of steam generator.

5. Air & Refrigeration

Introduction, use of air as chemical raw material & utility, concept of compressed air, blower air, fan air, instrument air etc., various methods of refrigeration in brief like ice, evaporate, vapor, steam jet refrigeration etc, types of refrigerating agent like ammonia, carbon dioxide, methylene chloride, water brine etc., selection of refrigerating agents.

Text book:

- Chemtech vol. I - D. Venkateswarlu
- Plant Utilites – Ghawane

Reference book:

2. Non-conventional energy sources - G. D. Rai

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3DCH05 PLANT DESIGN, MANAGEMENT & ECONOMICS

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	-	1	60	40	-	-	100

1. Organization structure & organizational dynamics:

Definition, Goals & factors considered for organization structure, Division of labour, Scalar & functional processes, Span of control, Delegation of authority, Centralization of decentralization, Types, Advantages and disadvantages, Application of organization structure, org. culture & factors.

2. Material, Finance, Production & Marketing Management:

Definition, Function, Importance & brief idea about all these kind of management

3. Production, Planning and Control

Concept of Production, planning and control, Objectives, functions of production, planning and control etc.

4. Introduction of Plant Design

Importance of Chemical Engg. Plant Design, Role of chemical engineer in Plant Design, Need for Plant Design, Basis for good design, Relation of Plant Design with sales.

5. Development of Chemical Plant Project

Objectives for development of project, Process evaluation stages with description, Technical factors, Economic factors, Legal phase, and sources of information.

6. Process Design for Chemical Plant

Choice of process, selection of process cycle, continuous versus batch process, shift-operating time schedules types of flow diagrams.

7. Selection of Chemical Process equipments, Auxiliaries & Material

Selection of process equipment, Standard vs. special equipment, Selection of various equipments like size reduction, material handling, heat transfer, mass transfer equipments etc., selection of pumps, Piping, - ferrous pipe and tubes, non- metallic pipe, Selection of pipes & Tubes, Insulation, types of insulation, factors governing selection of insulation, application of pipe insulation

8. Layout & Location of Chemical Plant:

Importance of plant layout, factors in planning layout, methods of layout planning, unit area concept, two dimensional layout, scale models, principles of plant layout, site location, Primary and secondary factors considered in the plant location.

9. Plant Economics

Estimation of total product cost, fixed capital investment, working capital investment, over- head charges, payout period, Break-even point, Causes of Depreciation, types and methods of determining depreciation

Textbooks:

1. Plant design & Economies for Chemical Engineers - M.S.Peters and K.D.Timmerhaus
2. Chemical Engineering Plant Design - F.C.Vilbrandt and C.E.Dryden.
3. Industrial Management. – Atul Prakashan

Reference:

1. Modern production Management - Butta.
2. Material Management - N. Nair.

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3DCH 06 INTRODUCTIONS TO YOGA

Teaching Scheme (Hours/Week)		Examination Scheme (Marks)			Total (Marks)
Theory	Practical	Theory	Practical	T/w	
1	1	---	50	--	50

(A) THEORY

YOGA & MEDITATION (7+3)

Concept/Introduction to Yoga(1)

Introduction, Definition of Yoga, Misconception of Yoga in modern time, Importance of Yoga with respect to the Soul, Mind and Body triangle of Human.

Types of Yoga

Brief about different Yoga- Astang yoga, Hath Yoga, Gyan Yoga, Karma Yoga, Bhakti Yoga, Raj Yoga, Mantra Yoga, Sahaja Yoga(Kundalini Yoga)

Kundalini Yoga(6)

Definition of basic terminologies- Subtle System, Kundalini, Self realization, Chakras(Energy centers), Nadis(Energy channels),

Energy centers – Mooladhara, Swadhisthan, Nabhi, Anahat, Visuddhi, Agya, Sahasrara.

(Location, Gross manifestation, Qualities, Function, Spoiling factors, Element,

Sensing points/parts of Chakras)

Energy Channels- Ida Nadi, Pingla Nadi, Sushumna Nadi (Location, Gross manifestation,

Qualities, Function, Spoiling factors, Element, Sensing points/parts of Chakras)

Sahaja Yoga – Unique revolution of modern time in Kundalini yoga

Concept/Introduction of Meditation

Introduction, Thoughtless awareness (1), Levels of Consciousness (1),

Practical session as per the technique of sahaja yoga(A unique science of yoga founded

by H.H.Shri Mataji Nirmala Devi)(1)

YOGA AND INNERPERSONALITY (3+1+1)

Stress Management (3) Introduction, Physical stress, Mental Stress, Managing a stress-by Pranayama, Meditation as a stress reliever,

Holistic Healthcare (1) Introduction, Yoga & Meditation for Physical & Mental health, Introduction to common holistic approaches like Ayurveda, Homoeopathy, Cosmic vibration therapy (Sahaja yoga)

Addiction free life (1), Introduction to addiction, types, Physical, Mental and Social effect of addictions, Comprehensive strategies adopted by Governmental bodies and NGOs to control addiction, Solution for

addiction by Yoga & Meditation.
General Health concept (1), Basics about food, Nutrition, Healthy (Sativik) food
concept according to Ayurveda

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(B) PRACTICAL (Basic Asans) (8)

TRAINING IN YOGIC ASANAS, PRANAYAMS AND MUDRAS

1. Kapalbhati, Anulom vilom, Pranayam, Omkar Pranayam, Bharmari, Pranayam,
Body

Roration, Shavasan, Suryanamaskar,

2. Asans for Meditaion

Padmasan, Swastikasan, Siddhasan, Bhadrasan, Vajrasan, Makarasan,
Savasan.

3. Asans to be performed in Standing Position

Trikonasan, Pervatasan, Utkatukasan, Hastpadsan

4. Asans to be performed while lying in Supine position

Servangasan, Halasan, Savasan, Kothavishramasan, Matshendrasan,
Suptavajrasan

5. Asans to be performed while lying in Prone position

Uttanpadasan, Uttanadhasan, Serpasan, Bhujasan, Salabhasan,
Dhanurasan, Makarasan

6. Asans to be performed in Sitting position

Pavanmuktasan, Hastapadasan, Vajrasan, Ardhamatshyendrasan,
Shishuasan, Saptamudrasan, Gomukhasan.

7. Yoga Mudras(Seven Types)

8. Pranayam (Seven Types)

4DCH01 : HEAT TRANSFER

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Fundamentals of Heat Transfer

Introduction, Engineering heat transfer and analogies between various transport processes, modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann law, Thermal conductance and resistance, Convective and radiative conduction, Combined heat transfer process.

2. Steady State Heat Transfer by conduction

Concept of heat conduction, Linear one-dimensional Heat conduction through wall, through cylinder and through sphere, Conduction through composite plane wall, conduction through composite cylinder, conduction through composite sphere, critical insulation thickness for pipes.

3. Heat Transfer by Convection

The nature of heat convection, The Nusselt Number, Determination of Nusselt Number, Forced convection (No derivation), Free convection (No derivation)

4. Heat Transfer By Phase Change

Heat transfer accompanied by phase change, Phenomenon of boiling, Regimes of pool boiling, Nucleate boiling & film boiling, Phenomenon of condensation, Application of general equations.

5. Thermal Radiation

Nature of thermal radiation, Absorption, Transmission, Reflection and Emission of Radiation, Emissive power of black body, Plank's distribution, Total emissive power, stefan-Boltzman law, Emissivity, Kirchoff's law, Black body, Wien's displacement law, radiation shields.

6. Heat Exchangers

Introduction, types of heat exchangers, overall heat transfer coefficient, Effect of scale formation, logarithmic mean temperature difference, L.M.T.D. correction factors, Extended surfaces.

7. Evaporation

Introduction, Liquid characteristics, types of evaporator, Duhring rule & boiling point elevation, economy & capacity, method of feeding , examples based on single effect evaporator.

Text Book :

1. Engineering Heat Transfer – Gupta & Prakash
2. Chemical Engineering unit operation – McCabe & Smith
3. Unit Operation – II - K.A. Gavane

Reference :

1. Heat Transfer – J.P. Holman
2. Heat Transfer – D.Q. Kern
3. Fundamentals of Heat & Mass Transfer - Sachendra

4DCH02 : Fluid Flow Operations

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Fluid Statics:

Definition of fluid, fluid mechanics, static pressure, head, gauge pressure, absolute pressure, dynamic pressure, vacuum. Pressure measuring devices, Simple U tube manometer, differential U tube manometer, inclined tube manometer, measurement of absolute and gauge pressure by manometer, manometric liquids, purpose of pressure measurement. Mechanical pressure gauges, Bourdon tube, diaphragm & bellow gauges. Derivation & Calculation of pressure drop.

2. Fluid dynamics :

Purpose of flow measurement, definition of average mass & volumetric flow rates, Classification of flow meters, orifice meter, venturimeter, pitot tube, flow nozzle, rotameter, open weirs. Comparison & merits-demerits of flow meters. . Calculation of flow rates by direct use of formulas.

3. Behavior of different types of fluids :

Definitions of ideal & real fluids, Newtonian & non-Newtonian fluids, behaviour of non Newtonian fluids, definitions of different viscosities, viscosity measurement by Hagan Poiseuille's method, steady state & unsteady state flow. Reynold experiment, conclusions, definition of laminar flow, turbulent flow, and Reynold number, critical velocity, transition flow, assumptions of simple & modified Bernoulli's equation and its applications. Friction factor chart, significance, roughness parameter, relative roughness, skin friction, form friction comparison. Derivation of Fanning's friction equation. Head loss & pressure drop through pipe calculation. net head developed by pump, fluid HP, BHP calculation.

4. Transportation of fluids :

Pipes, tubes, pipe size, pipe fittings, their uses & sketches, joints-flange, expansion, Different types of valves, their construction, function & uses. Classification of pumps. Centrifugal pumps- volute & turbine type. Positive displacement pumps & gear, sliding vane, lobe, piston, plunger & diaphragm types fans – centrifugal forward & backward curved blades type. Blowers & compressors – reciprocating & rotary types (all fluid moving machineries are in brief) characteristic curves of centrifugal pump. Derivation of NPSH & calculation. Cavitation – causes & remedies.

5. Conveying :

Pneumatic type – vertical & horizontal types, Hydraulic type – vertical & horizontal types homogeneous flow & Industrial applications.

6. Fluidization :

Aggregative & particulate types. Mechanism, applications, calculation of pressure drops through fluidized bed. Comparison of packed & fluidized beds, their merits, demerits & applications.

7. Level measurement :

Direct level measurement – tape, sight glass & float methods. Indirect level measurement – Air trap box, diaphragm box, bulbar system, differential U tube manometer methods.

Textbooks :

1. Unit Operations in Chem. Engg. - McCabe & Smith
2. Introduction to Chem. Engg. - Badger & Banchero.

Reference :

- 1 Principles of Unit Operations -Foust & Wenzel 2 Industrial Instrumentation - Eckman
- 2 3 A text book of fluid mechanics - R. S. Khurmi 4 Instrumentation - Kerk & Rimboy

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4DCH03: PROCESS CALCULATION

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	--	1	60	40	-----		100

1. Introduction

Dimensions & Units, Different systems of units, Conversion of units & simple problems on such topics.

2. Basic Chemical Calculation

Composition of solids, Liquid mixtures, Ideal gas law, Gas constant, Composition of gaseous mixtures, Dalton's & Amagat's law and simple problems on above topics.

3. Material Balance

Concepts and importance of material balance, Classification of material balance Problems, Problems based on tie material, Inert material balance & simultaneous equation involving various unit operations, Concepts of recycle, purge and bypass.

4. Material Balance with chemical reaction

Simple steady state material balance problems with chemical reaction.

5. Energy Balance

Forms of energy, Concepts of C_p , C_v , Calculation of enthalpy change, Thermo chemistry involving concepts & simple calculations of ΔH_c , ΔH_R & ΔH_f , Simple energy balance problems.

6. Combustion

Types of fuels, calorific value, Simple problems to find out the air requirement & composition of exit gases etc.

Text Book:

1. Stoichiometry - Bhatt & Vora.

Reference:

1. Basic principles of calculation in chemical engineering - Himmelbau.

4DCH04: MASS TRANSFER – I

Teaching Scheme (hr/W)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Introduction

Importance of mass transfer operations, classification of mass-transfer operations, methods of conducting mass transfer operations and fundamental design principles.

2. Molecular Diffusion Of Fluids

Concept of molecular and eddy diffusion, Fick's law for diffusion, general equation for steady-state molecular diffusion in fluid within laminar flow, thermal diffusion, simple problems on diffusion by direct use of formula.

3. Interphase Mass Transfer

Concept of equilibrium, local and average overall mass transfer coefficient, film theory, penetration theory, analogy between mass and momentum transfer and concept of stage, stage efficiency, cascade etc.

4. Gas Absorption

Definition and application of absorption, equilibrium solubility of gases in liquids, effect of temperature and pressure on solubility, characteristics of ideal liquid solutions of Raoult's law, choice of solvents, material balance for the component transfer in counter current and concurrent flow, concept of HETP and simple problems on absorption.

5. Liquid-Liquid Extraction

Definition and application of liquid extraction, liquid equilibrium for three component system, equilibrium triangular coordinates, system of three liquids one pair partially soluble, effect of temperature and pressure on the solubility curve, choice of solvents for the operation, simple problems using direct formula.

6. Leaching

Definition and industrial application of leaching, preparation of solid, methods of operations and equipment for in place leaching and heap leaching, shanks system, filter-press leaching and equipment like Rotacel, Kennedy extractor and Balloman extractor.

7. Equipment For Gas-Liquid Operation

Construction and working of gas dispersed equipments like bubble column (Sparged vessel), agitated vessel, tray tower etc. and liquid dispersed equipments like venturi scrubbers, wetted wall column, spray tower, packed tower and comparison between tray and packed tower.

Text books:

1. Mass Transfer Operations - Robert E. Treybal, Mc-Graw Hill Publications.

Reference:

1. Unit operations in chemical engineering - McCabe & Smith.
2. Introduction to chemical engineering -Badger & Banchero.

3. Chemical engineering vol. 2 -Coulson & Richardson.

4. Hand book of chemical engineering - J.H.Perry.

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4DCH05: INSTRUMENTATION

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	--	1	60	40	--	--	100

1. Introduction to Instrumentation

Concept and importance of instrumentation, classification of instruments, basic elements of instruments, characteristics of instruments in detail, brief explanation of first order system and second order system.

2. Temperature Measuring Devices

Definition of thermometer, temperature scale, mercury in glass thermometer, Bimetallic & pressure spring thermometers, Principle of thermo electricity, Sebeck effect, Peltier effect & Thomson effect, Industrial thermocouple, lead wire thermowells, Resistance thermometer, Single wheatstone bridge circuit & Null bridge resistance thermometer, Deflection resistance thermometer circuit, Radiation & Optical pyrometers.

3. Measurement of Pressure & Vacuum

Pressure, Vacuum & Head measuring elements for gauge pressure & Vacuum, Indicating elements for pressure gauges, Brief explanation about measurement of absolute pressure, Measuring pressures in corrosive fluids, Static accuracy of pressure gauges, Response of Mechanical Pressure gauges.

4. Measurement of Head & Level

Head, density & Sp. Gravity, Direct measurement of liquid level, Pressure (Level) measurements in open vessel, level measurement in pressure vessels, Measurement of Interface level, Density measurement, level measurement by weighing, level of dry materials.

5. Process Recording Instruments

Recording Instruments, Indicating & Signaling Instruments, and Transmission of instrument readings, Control center, and Instrumentation diagram.

6. Distributed Control Systems

Principle of working, important control modes with simple diagram, Comparison of PLC & DCS system, Principle of modem.

Textbooks:

1. Industrial instrumentation - Donald P Eckman
2. Instrumentation - K. Johnson
3. Industrial Instrumentation & Control - S. K. Singh
4. Instrumentation - Eckman

4DCH06: CHEMICAL ENGINEERING EQUIPMENT DRAWING

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
-	3	-	-	-	50	25	75

Refer and draw the standard code/decodes and symbols for Chemical Engineering equipments.

Prepare sketches of various types of Valves, Pipe fittings, Joints etc.

Free hand sketch drawing of various Chemical Engineering Unit Operation equipments like Heat Transfer equipments, Mechanical Operation equipments, Mass Transfer equipments etc.

References :

1. Outlines of Chemical Technology – Gopala Rao.
2. Chemical Engineering Unit Operation – McCabe Smith.
3. Introduction to Chemical Engineering – Badger & Banchero.

5DCH01: MASS TRANSFER – II

Teaching Scheme (hr/W)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Distillation

Importance of distillation as separation method, vapor-liquid equilibrium, relative volatility, ideal solutions with Raoult's law, Henry's law, maximum & minimum liquid azeotropes, flash vaporization with material balance calculation, calculations of vapor-liquid equilibrium, Differential distillation with Rayleigh's equation of simple calculation, steam distillation, continuous rectification – binary system based on McCabe & Thiele methods with calculation, Extractive & Azeotropic distillation

2. Humidification

Concept of partial pressure & vapor pressure, definitions & simple calculations for absolute humidity, relative saturation & percentage saturation, concept of wet bulb temperature, dry bulb temperature, dew point, humid volume, humid heat, psychrometric chart, construction & working of different types of cooling tower, spray pond.

3. Drying

Applications, understanding of various definitions, types and classification of drying operations, equipments, freeze drying, drying test and derivation of equations for drying time and simple calculations.

4. Adsorption and Ion Exchange

Concept and application, types of adsorption, hysteresis, characteristics and nature of adsorbents, effect of temperature, Freundlich equation and its applications for single stage operation, heatless adsorber, major applications and factors affecting ion-exchange.

5. Crystallization

Concept and application, methods for supersaturation, classification of crystallizer, Meir's theory, concept of nucleation and crystal growth, effect of seeding and simple calculations for percentage yield, construction and working of Swenson Walker, tank, DTB, Krystal and Vacuum crystallizes.

Text books:

1. Mass Transfer Operations - Robert E. Treybal , Mc-Graw Hill Publications.

Reference:

1. Unit operations in chemical engineering - McCabe & Smith.
2. Introduction to chemical engineering - Badger & Banchero.
3. Chemical engineering vol. 2 - Coulson & Richardson.
4. Hand book of chemical engineering - J.H.Perry.

5DCH02: ELEMENT OF THERMODYNAMICS AND REACTION ENGINEERING

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	--	1	60	40	--	--	100

- 1. Introduction and First law of thermodynamics**
Scope of thermodynamics, Internal energy, the first law of thermodynamics, Thermodynamics State and static function, Enthalpy, The steady state flow process Equilibrium, The phase rule, the reversible process, Constant volume and constant pressure process, Heat capacity.
- 2. Second law of thermodynamics**
Statement of the second law of thermodynamics, thermodynamics temperature scale, Entropy, Entropy change of an ideal gas, Mathematical statement of the second law, the third law of the thermodynamics
- 3. Introduction to refrigeration and liquefaction**
The Carnot refrigeration, the vapor compression cycle, Compression of refrigeration cycle, the choice of refrigerant, Adsorption refrigeration, heat pump Liquefaction process
- 4. Introduction to reaction engineering**
Thermodynamics, Chemical kinetics, Classification of reactions, Variable affecting the rate of reaction, Definition of rate.
- 5. Kinetics of homogeneous reaction**
 - (1) Concentration dependent term of a rate equation
 - ⇒ Single and multiple reaction
 - ⇒ Elementary and nonelementary reaction
 - ⇒ Kinetic view of equilibrium for elementary reaction
 - ⇒ Molecularity and order of reaction
 - ⇒ Representation of reaction rate
 - ⇒ Testing of kinetic model
 - (2) Temperature dependent term of a rate equation
 - ⇒ Arrhenius law
 - ⇒ Collision theory
 - ⇒ Transition state theory
 - ⇒ Comparison of theory
 - ⇒ Comparison of theory with Arrhenius law
 - ⇒ Activation energy and temperature dependency
 - ⇒ Rate of reaction prediction by the theories
(No derivation for all topics)
- 6. Interpretation of batch reactor data**
Constant volume batch reactors, Temperature and rate of reaction, the search of rate equation.
- 7. Introduction to reactor**
Batch reactor; plug flow reactor, continuous stirred tank reactor.

Text book: -

1. Chemical engineering thermodynamics - Smith and Vanness
2. Chemical reaction engineering & Thermodynamics - Ghavane

Reference book: -

1. Physical chemistry - Bhall and Tuli 2 Chemical kinetics - J. M. Smith
3 Chemical reaction engineering - Octave Levenspiel 4 Thermodynamics - P. K. Nag

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5DCH03: Petroleum Refining & Petrochemical Technology

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Origin, Formation & Composition of Petroleum

Origin & formation of petroleum, Reserves & deposit of world, Indian petroleum refineries with their location & capacity, composition of petroleum.

2. Petroleum Processing Data

Classification of crude oil, Crude Assay Analysis, ASTM Distillation, Thermal properties of petroleum.

3. Fractionation of Petroleum

Dehydration & Desalting of crude, pipe still heaters, Distillation of crude oil, Important products, properties & test methods, additives for various petroleum products.

4. Treatment Techniques

Physical & Chemical Impurities, Treatment of gasoline, Kerosene & lubes by various methods. Removal of sulfur and sulfur compound.

5. Thermal & Catalytic Processes

Objective of cracking & Reforming operations, effect of temperature & pressure on cracking, advantages of cracking, Reforming & Platforming.

6. Introduction of Petrochemical Industry

Definition, History, Major Petrochemical products and their producers in India, Raw materials for Petrochemicals, Characteristics of Petrochemical Industry.

7. Manufacture of C₁ compound

Methanol, Formaldehyde.

8. Manufacture of C₂ compound

Ethylene & Polyethylene, Vinyl chloride, Ethanol, Ethylene di-chloride, Ethylene oxide.

9. Manufacturing of C₃ compound

Propylene & Polypropylene, Cumene, Acrylonitrile.

10. Manufacture of C₄ Compound

Butadiene, Iso butylene, Butanol.

11. Aromatics Chemicals

Styrene LAB, Phenol, Terphthalic acid & DMT, Phthalic anhydride & Malaik anhydride.

Text Books:

1. Petroleum Refining - B.K. Bhaskar Rao.
2. Petrochemicals - B.K. Bhaskar Rao.

Reference :

1. Advanced Petroleum Refining - G.N. Sarkar.
2. Petroleum Refining Engineering - Nelson.
3. Petroleum Technology, Volume – I - Ludivig

5DCH04 FERTILIZER TECHNOLOGY

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	3	1	60	40	50	25	175

1. Introduction

Need of fertilizer, type of fertilizer, merits and demerits of fertilizer, fertilizer industries at glance.

2. Nitrogenous fertilizer

Role of Nitrogenous fertilizer, sources and properties of hydrogen, nitrogen and ammonia, manufacture of synthesis gas by steam hydrocarbon, reforming and partial oxidation methods, synthesis of ammonia, types of converters, storage and handling of ammonia.

- A. Urea: properties and uses, manufacture of urea by total recycle process with Montocetini and Toyokotsu process.
- B. Ammonium nitrate: properties, manufacturing process and uses.
- C. Ammonium sulfate: properties, manufacturing processes and uses.
- D. Ammonium chloride properties, manufacturing processes and uses.

3. Potassium fertilizer

Role of potassium as fertilizer, properties, and sources of potash and production of KCl.

4. Phosphatic fertilizer

Role of potash as fertilizer, types of rock phosphate, production of elemental phosphorus (yellow or red) manufacture. of phosphoric acid by wet method, electric arc furnace method, production of normal and super triple phosphate, ammonium phosphate, major engineering problem of such industries.

5. Mixed fertilizer

Manufacture and granulation of mixed fertilizer and bulk blending.

6. Environmental aspects of fertilizer industry

Brief idea about air pollution, methods of controlling the air pollution and effluent treatment for fertilizer industries.

Text book:

1. Dryden's Outline of Chemical Technology – Gopal Rao
2. Shrieve's Chemical Process Industries – George Austin.

Reference:

1. Chemistry and Technology of Fertilizers – Vincent Sauchelli, Reinhold publications Corporation.

5DCH05 Dyes and Dyes Intermediate Technology

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	-	1	60	40	-	-	100

1. Introduction and classification of Dye & Dye-Intermediate

- Classification of dyes: By application, by Manufacturing & by color code.
- R. M. & testing parameter
- Basic Unit Operations involved in manufacturing of dyes: Filtration, Size reduction, Sublimation, Freezing, Precipitation, Decantation, Filtration, Centrifugation, , Blending, Crystallization, Drying, Evaporation, Distillation, Extraction
- Basic Unit Processes in manufacture of Dyes: Nitration, Sulfonation, Alkylation, Amination by reduction, Amination by amonolysis, Helogenation, Hydrolysis, Hydroxylation, Oxidation, Esterification, Hydrogenation, Diazotization, Cynurization, Coupling, Isolation.

2. Dyes Intermediate

- Benzene Series: Name, structure, physical properties, Chem. Rxn, Mfg. process, application.
- Naphthalene Series: Name, structure, physical properties, Chem. Rxn, Mfg. process, application.
- Anthracene Series: Name, structure, physical properties, Chem. Rxn, Mfg. process, application.
- Hetrocyclic series: Name, structure, physical properties, Chem. Rxn, Mfg. process, application.

3. Dyes:

- Introduction, Mfg process of Dyes.
- Reactive dye: Reactive Black B, Turquoise Blue, Congo Red, Acid Yellow 3.
- Vat dye: Indigo, – Monoazo type, Diazo type.
- Basic dye: Rhodamine, Methylene Blue, Acid Dyes, – Acid Blue 45, Acid Green 25.

4. Pigments:

- Classification of Pigments – Organic Pigments, Inorganic Pigments, Manufacturing Processes – CPC Green, CPC Blue, Uses of Pigments.

5. Application of Dye:

Types of Fiber, Dyeing Methods, Fastness Properties of dyestuff – Washing Fastness, Light Fastness, Degree of staining

6. Effluent Treatment methods in Dye-Industries\

- Physical methods, Chemical methods, Biological methods

RECOMMENDED BOOKS

1. Technology of Dyeing by V.A Shenai; Sevak Publishers, Mumbai.
2. Dyeing and Chemical Technology of Textile Fibres by E.R Trotman; B.I. Publication, New Delhi.
3. A textbook of Dyes by Arora.
4. Dyes and their Intermediates by Abrahart.
5. Dyes and their Intermediates by Chatwal.
6. Introduction to the Chemistry of Dyestuffs by V.A. Shenai, Sevak Publishers,

Mumbai.

7. Dyes and Dyeing by Charles E. Pellow; Abhishek Publishers, Chandigarh.
8. Fundamental Processes of Dye Chemistry by Fierz-David.

SunRise University

5DCH05 Polymer Technologies

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
3	-	1	60	40	-	-	100

1. Introduction to polymers (9)

Brief history, About polymers, Classification of polymers according to chemical and geometrical structure of polymer molecules, General remarks on polymer microstructure, Microstructure based on the chemical structure – Organic and inorganic polymers, Homochain and heterochain polymers, Homopolymers and copolymers, Microstructure based on the geometrical structure – Linear, branched and cross-linked polymers, Random, alternating, block and graft co-polymers, Stereo-regular polymers – Optical isomerism, Geometrical isomerism, glass transition temperature

2. Chemistry of Polymerisation (5)

Introduction, Chain polymerisation – Free radical polymerisation, Ionic polymerisation, Introduction to catalytic polymerisation, Step polymerization

3. Polymerization Techniques (3)

Bulk polymerisation, Solution polymerisation, Suspension polymerisation, Emulsion polymerisation, Melt polycondensation, Solution Polycondensation, Interfacial polymerization

4. Plastics (7)

Introduction, Classification of Plastics, Raw Materials, Preparation, properties, and applications for the Addition Polymerization Products like Poly Ethylene, LDPE, HDPE, PVC, Poly Styrene, Alloys, blends, and composites, Engineering Plastics like Nylon, ABS, Poly Carbonates, TEFLON etc, Recent trends in plastics like bio degradable plastics etc.

5. Rubbers (3)

Introduction and classification of rubber, vulcanization, reinforcement with carbon black, Natural rubber, Preparation, properties, and applications of synthetic rubbers like SBR, Poly Butadiene, Poly Ethylene-Propylene & Butyl Rubber, Brief of some important rubber like Nitrile rubber, Neoprene, Reclaim Rubber.

6. Resins for Adhesives and Protective Coating (3)

Introduction, Condensation polymerization products like Phenol Formaldehyde (Phenolic Resins), Amino Resins, Polyester Resins, Alkyl Resins and Epoxy Resins, Polyurethane Resins, Poly Amide Resins

7. Fiber and Film (5)

Introduction to fiber, Properties of fiber, Cellulosic fiber: Viscose Rayon and Cellulose Acetate, Polyamide fibers, Polyester fiber, Acrylic fibers, carbon fibers, Films: Viscose & Cellulose Acetate, Poly olefins, Poly Vinyl Chloride

8. Polymer processing (6)

Extrusion, injection molding, compression molding, blow molding, film extrusion, spinning, extrusion film blowing, etc.

Text book:

1. **Polymer Science** by V R Gowarikar.
2. **Outlines of polymer Technology** by R Sinha

Reference book:

1. **Textbook of polymer science** by Fred W Billmeyer Jr.
2. **Experimental methods of Polymer** by A Ya. Malkin et al.

6DCH 01: Industrial Training / Project Work

Teaching scheme (Hr/w)			Exam Scheme (Marks)				
L	Pr	T	Th	Sess	Pr	Tw	Total
-	-	-	-	-	100	50	150

A student will undergo in-plant training for about 18 weeks and submit a training report which covers following aspects **or** he will prepare a complete project report comprising product properties, various manufacturing processes, process selection, material balance energy balance, plant location and layout etc. under the guidance of concerned faculty.

1. Factory Organisation

Operation, Supporting, Engineering Services, Plant Location, Layout, Waste management, Utility Supply.

2. Operation of Chemical Plant

Key activities, Technology absorption, Process control, Safety Awareness/Emergency Handling, Troubleshooting, and In-process Quality Control.

3. Construction/Working/Operation/Inspection of

Pipes/Pipe fittings, Instruments, Distillation Tower, Filtration, Centrifuges, Heat Exchanger, Evaporator, Drier, Cooling Towers, Pumps etc.

4. Concept of Startup / Shutdown / Emergency handling / Maintenance etc.