 <b>MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI</b> <b>TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES</b>																	
<b>COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING</b>																	
<b>COURSE CODE : CH</b>																	
<b>DURATION OF COURSE : 6 SEMESTERS</b>										<b>WITH EFFECT FROM 2012-13</b>							
<b>SEMESTER : THIRD</b>										<b>DURATION : 16 WEEKS</b>							
<b>PATTERN : FULL TIME - SEMESTER</b>										<b>SCHEME : G</b>							
SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										SW (17300)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Applied Mathematics \$	AMS	17301	03	--	--	03	100	40	--	--	--	--	--	--		
2	Industrial Chemistry	ICH	17312	04	--	02	03	100	40	--	--	--	--	25@	10	<b>50</b>	
3	Mechanical Operation	MOP	17313	04	--	04	03	100	40	50#	20	--	-	25@	10		
4	Chemical Process Technology-I	CPT	17314	04		04	03	100	40	50#	20	--	--	50@	20		
5	Stoichiometry	STO	17315	03	02	--	03	100	40	--	--	--	--	--	--		
6	Professional Practices-I	PPO	17019	--	--	03	--	--	--	--	--	--	--	50@	20		
<b>TOTAL</b>				<b>18</b>	<b>02</b>	<b>13</b>	<b>--</b>	<b>500</b>	<b>--</b>	<b>100</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>150</b>	<b>--</b>		<b>50</b>

Student Contact Hours Per Week: **33 Hrs.**  
**THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.**  
Total Marks : **800**  
@ - Internal Assessment, # - External Assessment,   No Theory Examination, \$ - Common to all branches.

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

**Course Name : All Branches of Diploma in Engineering & Technology**

**Course Code : AE/CE/CH/CM/CO/CR/CS/CW/DE/EE/EP/IF/EJ/EN/ET/EV/EX/IC/IE/IS/  
ME/MU/PG/PT/PS/CD/CV/ED/EI/FE/IU/MH/MI**

**Semester : Second**

**Subject Title : Applied Mathematics**

**Subject Code : 17301**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	--	03	100	--	--	--	100

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

**Rationale:**

Applied mathematics is designed for its applications in engineering and technology. It includes the topics integration, differential equation, probability distribution. The connection between applied mathematics and its applications in real life can be understood and appreciated.

Derivatives are useful to find slope of the curve, maxima and minima of function, radius of curvature. Integral calculus helps in finding the area. In analog to digital converter and modulation system integration is important. Differential equation is used in finding curve. Probability is used in Metrology and quality control.

The fundamentals of this topic are directly useful in understanding engineering applications in various fields.

**General Objectives:**

Students will be able to:

1. Apply derivatives to find slope, maxima, minima and radius of curvature.
2. Apply integral calculus to solve different engineering problems.
3. Apply the concept of integration for finding area.
4. Apply differential equation for solving problems in different engineering fields.
5. Apply the knowledge of probability to solve the examples related to the production process.

**Learning Structure:**

**Applications**

Apply the principles of mathematics to solve examples in all branches of Engineering Diploma.

**Procedure**

Solving problems of tangent, normal. Finding maxima, minima and radius of curvature

Solving problems on methods of integration and its properties. Finding area.

Solving examples of differential equations of first order and first degree.

Solving different examples on binomial, poisson and normal distribution

**Principle**

Methods of finding slope, curvature, maxima and minima

Methods of finding integration, definite integration and its properties

Methods of differential equations of first order and first degree

Formulae for binomial, normal, and poisson distribution

**Concept**

Geometrical meaning of derivatives, increasing and decreasing functions

Integration of standard functions. Rules of integration, integration by parts, partial fractions

Order and degree of differential equation. Formation of differential equation

Probability of repeated trails of random experiments

**Facts**

First order and second order derivatives

Derivatives, notation of integration, definition of integration

Integration, definition of differential equation

Permutation , Combination, probability of an event

**Theory:**

<b>Topic and Contents</b>	<b>Hours</b>	<b>Marks</b>
<b>Topic-1 Applications of Derivative</b> <b>Specific objectives :</b> <ul style="list-style-type: none"> <li>➤ Find slope, curvature, maximum and minimum value of functions related to different engineering applications. <ul style="list-style-type: none"> <li>• Examples for finding slope , equations of tangent and normal to the curve</li> <li>• Maxima and minima.</li> <li>• Radius of curvature.</li> </ul> </li> </ul>	06	16
<b>Topic-2 Integral Calculus</b>		
<b>2.1 Integration ----- 20</b> <b>Specific objectives :</b> <ul style="list-style-type: none"> <li>➤ Integrate function using different method. <ul style="list-style-type: none"> <li>• Definition of integration as anti derivative, rules of integration.</li> <li>• Integration of standard functions</li> <li>• Methods of integration <ul style="list-style-type: none"> <li>Integration by substitution.</li> <li>Integration by partial fractions.</li> <li>Integration by parts and generalized rule by parts.</li> </ul> </li> </ul> </li> </ul>	14	44
<b>2.2 Definite Integrals ----- 16</b> <b>Specific objectives :</b> <ul style="list-style-type: none"> <li>➤ Solve problems on definite integrals using the properties. <ul style="list-style-type: none"> <li>• Definite integral- Definition, examples.</li> <li>• Properties of definite integrals without proof and simple examples.</li> </ul> </li> </ul>	08	
<b>2.3 Application of Definite Integrals -----08</b> <b>Specific objectives :</b> <ul style="list-style-type: none"> <li>➤ Find area. <ul style="list-style-type: none"> <li>• Area under a curve.</li> <li>• Area between two curves.</li> </ul> </li> </ul>	04	
<b>Topic 3 - Differential Equation.</b>		
<b>3.1 Differential equation</b> <b>Specific objectives :</b> <ul style="list-style-type: none"> <li>➤ Solve the differential equation of first order and first degree</li> <li>➤ Solve different engineering problems using differential equation <ul style="list-style-type: none"> <li>• Differential equation- Definition, order and degree of a differential equation. Formation of differential equation containing single constant.</li> <li>• Solution of differential equation of first order and first degree for following types <ul style="list-style-type: none"> <li>Variable separable form,</li> <li>Equation reducible to variable separable form.</li> <li>Linear differential equation.</li> <li>Homogeneous differential equation.</li> <li>Exact differential equation.</li> </ul> </li> </ul> </li> </ul>	10	20

<b>Topic 4 - Probability</b>		
<b>4.1 Probability</b> <b>Specific objectives :</b> ----- <b>08</b> ➤ Solve different engineering problems related to probability process. <ul style="list-style-type: none"> <li>• Definition of random experiment, sample space, event, occurrence of event and types of event (impossible, mutually exclusive, exhaustive, equally likely)</li> <li>• Definition of probability, addition and multiplication theorems of probability.</li> </ul>	02	20
<b>4.2 Probability Distribution</b> ----- <b>12</b> <ul style="list-style-type: none"> <li>• Binomial distribution</li> <li>• Poisson's Distribution</li> <li>• Normal distribution</li> </ul>	04	
<b>Total</b>	<b>48</b>	<b>100</b>

**Learning Resources:****1) Books:**

<b>Sr. No</b>	<b>Title</b>	<b>Authors</b>	<b>Publication</b>
1	Mathematic for Polytechnic	S. P. Deshpande	Pune Vidyarthi Girha Prakashan' Pune
2	Calculus : Single Variable	Robert. T. Smith	Tata McGraw Hill
3	Higher Engineering mathematics	B. V Ramana	Tata McGraw Hill
4	Higher Engineering mathematics	H. K. Dass	S .Chand Publication
5	Higher Engineering Mathematics	B. S. Grewal	Khanna Publication, New Delhi
6	Applied Mathematics	P. N. Wartikar	Pune Vidyarthi Griha Prakashan, pune

**2) Websites :**i) [www.khan academy](http://www.khan.academy)

**Course Name : Diploma in Chemical Engineering**

**Course Code : CH**

**Semester : Third**

**Subject Title : Industrial Chemistry**

**Subject Code : 17312**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	--	25@	125

**NOTE:**

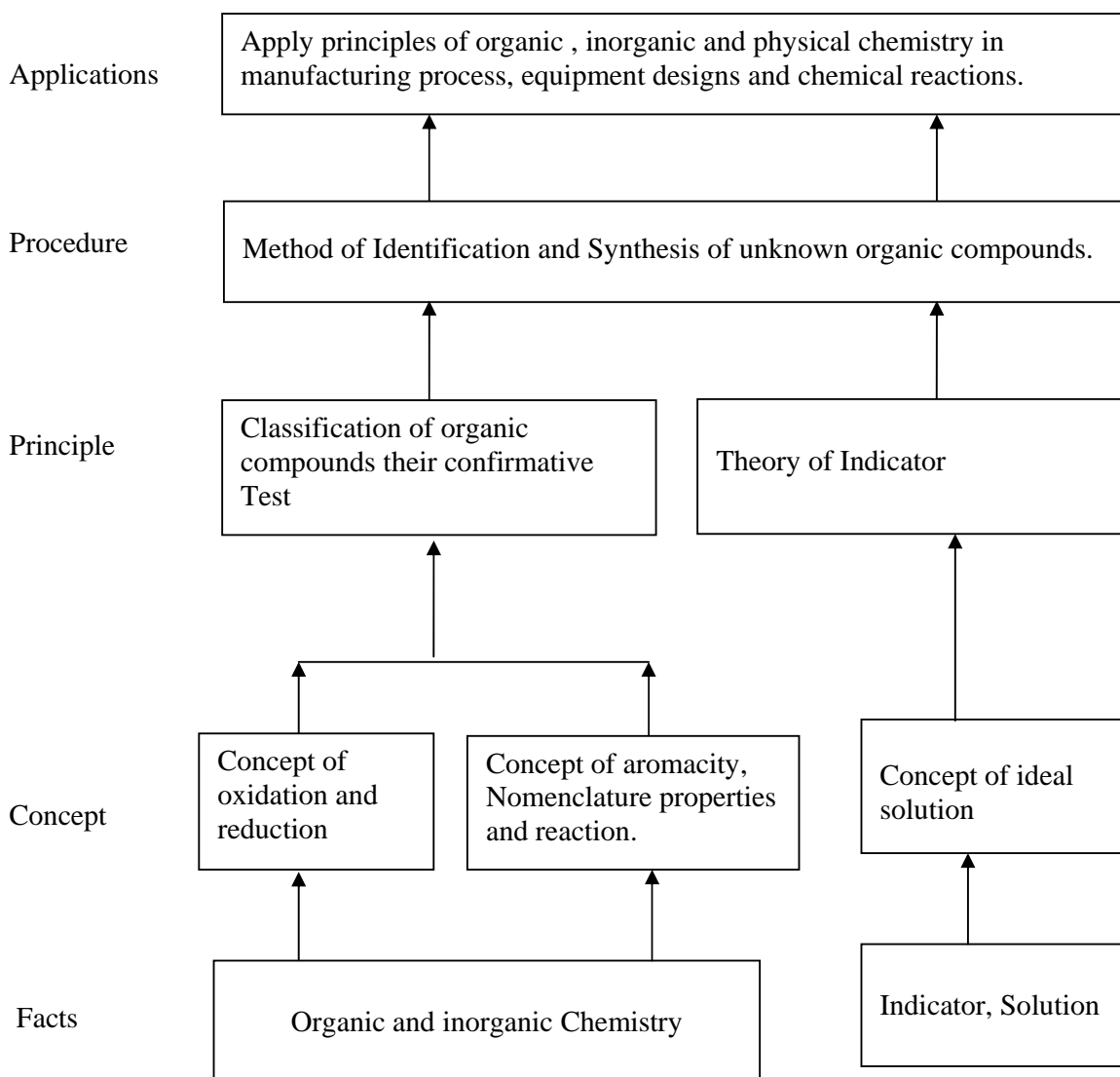
- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

**Rationale:**

This subject will cover knowledge of basic organic compounds. Methods of preparation of organic compound. Identify the properties of various organic compounds & uses of organic compounds. Properties of inorganic compounds. Subject gives guideline of solutions & indicators.

**General Objective: Student will be able to**

1. Understand identification of organic and inorganic compounds.
2. Know technique of handling glass ware.
3. Understand method of balancing reaction equation.
4. Understand purpose of different types of solution.
5. Use procedure for determination of properties of inorganic compound.

**Learning Structure:**

**Theory:**

Topics and Contents	Hours	Marks
<p><b>1. Chemistry of organic compounds</b></p> <p><b>Specific objective</b></p> <p>&gt; Classify organic compound based on structure</p> <p>&gt; State the rules of Nomenclature</p> <p><b>Contents:</b></p> <p>Define organic and inorganic Chemistry</p> <p>Importance of organic chemistry</p> <ul style="list-style-type: none"> <li>• Classification of organic compounds, <ul style="list-style-type: none"> <li>- Based on structure (aliphatic compound, closed chain compound, unsaturated compounds)</li> <li>- Based on functional group.</li> </ul> </li> <li>• General characteristics of organic compounds - Isomerism, polymerization, solubility, melting point, odour, combustibility</li> <li>Functional group.</li> <li>• Homologous series.</li> <li>• Nomenclature of organic compounds.(common name, Derived name, IUPAC name)</li> </ul>	07	16
<p><b>2. Alkanes, Alkenes, Alkynes &amp; Cycloalkanes</b></p> <p><b>Specific objective</b></p> <p>&gt; Describe given specific method of preparation for organic compound</p> <p>&gt; State the physical properties of given organic compound</p> <p>&gt; State the chemical reactions on given organic compound</p> <p><b>Alkanes (08)</b></p> <ul style="list-style-type: none"> <li>• Structural formula, Nomenclature, Classification of Alkanes</li> <li>• General methods of preparation <ul style="list-style-type: none"> <li>By Hydrogenation of Alkanes, Alkynes,</li> <li>By reduction of alkyl Halides,</li> <li>By Wurtz coupling reaction,</li> <li>By decarboxylation of carboxylic acids.</li> </ul> </li> <li>• Physical property of alkanes</li> <li>• Chemical property of Alkanes <ul style="list-style-type: none"> <li>Halogenations of Alkanes ,Nitration, Sulphonation, Combustion of Alkanes, Dehydrogenation,</li> <li>pyrolysis.</li> </ul> </li> <li>• Uses of Alkanes.</li> </ul> <p><b>Alkenes (06)</b></p> <p>Alkenes, structural formula, Nomenclature, IUPAC system,</p> <ul style="list-style-type: none"> <li>• Methods of preparation <ul style="list-style-type: none"> <li>By dehydration of alcohols</li> <li>By dehydrogenation of Alkyl halides</li> <li>By dehydrogenation of vicinal dehalides.</li> </ul> </li> <li>• Physical property of Alkenes.</li> <li>• Chemical property of Alkenes. <ul style="list-style-type: none"> <li>Addition of hydrogen, halogens ,halogen acids</li> <li>Water, oxidation with ozone. Polymerization.</li> </ul> </li> <li>• Uses of alkenes.</li> </ul>	16	26



<p><b>Alkynes (06)</b></p> <ul style="list-style-type: none"> <li>Alkynes, structural formula, Nomenclature, IUPAC system,</li> <li>Methods of preparation. From calcium carbide, From vicinal geminaldihalides. From tetra halides,</li> <li>Physical property of Alkynes.</li> <li>Chemical property of Alkynes. Addition of Halogens, halogen acids, sulphuric acids Water, ozonolysis.</li> <li>Uses of alkynes</li> </ul> <p><b>Cycloalkanes (06)</b></p> <ul style="list-style-type: none"> <li>Nomenclature, structural formula.</li> <li>Method of preparation.</li> <li>Physical property of Cycloalkanes.</li> <li>Chemical property of Cycloalkanes. Stability of cycloalkanes, Baeyer's strain theory, drawback of Baeyer's strain theory &amp; modification of Baeyer's strain theory.</li> </ul>		
<p><b>3. Aromatic compound</b> <b>Specific objective</b></p> <ul style="list-style-type: none"> <li>Describe given specific method of preparation for Aromatic Hydrocarbons.</li> <li>State Chemical reaction on given Aromatic Hydrocarbons</li> </ul> <p><b>3.1 Aromatic compounds and its homologues. (12)</b></p> <ul style="list-style-type: none"> <li>Nomenclature, structural formula.</li> <li>Examples of aromatic compound,</li> <li>Types of Aromatic Compounds.</li> <li>Difference between aliphatic &amp; aromatic Compounds.</li> <li>General methods of preparation of benzene &amp; its Homologues. - By heating an aromatic acid or its sodium salt with soda lime. - By hydrolysis of sulphuric acid with super heated steam. - By action of alkyl halides on benzene. - By heating halogen derivatives of benzene.- wartz fitting reaction.</li> <li>Physical property of Alkynes</li> <li>Chemical properties of benzene its homologues. Combustion, Nitration, Sulphonation, Oxidation, Reduction, Ozonide formation, Halogenation, Fiedal craft's reaction, Mercuration.</li> <li>Uses of aromatic compound.</li> </ul> <p><b>3.2 Phenols (10)</b></p> <ul style="list-style-type: none"> <li>Types of aromatic hydroxy compounds.</li> <li>Preparation of monohydric phenols, physical properties of phenols.</li> <li>Chemical properties of phenols.</li> <li>Uses of phenols.</li> </ul>	15	26
<p><b>4. Alcohol Chemistry</b> <b>Specific objective</b></p> <ul style="list-style-type: none"> <li>Describe given specific method of preparation for Alcohol.</li> <li>State Chemical reaction on Alcohol.</li> <li>State classification of Alcohol.</li> <li>Introduction of alcohols, classification of alcohols.</li> </ul>	05	16

<ul style="list-style-type: none"> <li>Nomenclature of alcohols</li> <li>• General method of preparation. <ul style="list-style-type: none"> <li>- From alkyl halides.</li> <li>- From alkenes.</li> <li>- From aldehydes and ketones by reduction and by using Grignard reagent.</li> </ul> </li> <li>• Physical properties of alcohols.</li> <li>• Chemical properties of alcohols. <ul style="list-style-type: none"> <li>- Action of sodium or potassium.</li> <li>- Reaction with hydrogen halides.</li> <li>- Action of phosphorus halides.</li> <li>- Reaction involving both Alkyl Group and Hydroxyl Group Dehydration.</li> </ul> </li> <li>• Uses of alcohols.</li> </ul>		
<p><b>5. Solutions &amp; Indicators</b></p> <p><b>Specific objective</b></p> <ul style="list-style-type: none"> <li>➤ State the theories of acid- base indicator.</li> <li>➤ State the theory of indicators.</li> <li>➤ Types of solutions.</li> </ul> <p><b>Solutions</b></p> <ul style="list-style-type: none"> <li>• Introduction, Definition of solution, types of solution Vapor pressure of liquid, Lowering vapor pressure.</li> <li>• Raoult's law for a solution of non-volatile solution , The p-x diagram for an ideal mixture of two liquids ,</li> <li>• Ideal solution and non ideal solution, type of ideal solution azotropic mixtures.</li> </ul> <p><b>Indicators</b></p> <ul style="list-style-type: none"> <li>• Indicators, titration, acid base indicators. Hydrogen-ion indicators,</li> <li>• Theories of acid base indicator. <ul style="list-style-type: none"> <li>Oswald's theory <ol style="list-style-type: none"> <li>1. Action of phenolphthalein,</li> <li>2. Action of methyl orange.</li> </ol> </li> <li>The Quinonoid Theory</li> </ul> </li> </ul>	05	16
<b>Total</b>	<b>48</b>	<b>100</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

- 1) Analysis of a given solution
- 2) To interpret the confirmative test

**Motor Skills:-**

- 1) Observe chemical reactions
- 2) Observation readings like boiling point and melting point
- 3) Handle the apparatus carefully

**List of Practical:-**

To analyze given organic compounds by qualitative analysis

- 1) Benzoic acid
- 2) Acetic acid
- 3) Aniline

- 4) Benzaldehyde
- 5) Chloroform
- 6) Napthylene
- 7) Chlorobenzene
- 8) Alpha or Bata naphthelene
- 9) Urea
- 10) Thiourea
- 11) Nitrobenzene

**Learning Resources:**

Sr. No	Author	Title	Publisher
01	Morrison and Boyd	Organic Chemistry	Allyn and Bacon Universal Bookstall, Boston.
02	Bahl & Bahl	Organic Chemistry	S Chand and Company
03	Bhupinder Mehta Manju Mehta	Organic Chemistry	PHI learning private limited
04	I & II by Finar	Organic Chemistry	--
05	M Gopala Rao	Dryden Outline of Chemical Technology	East West Publishers 1997, New Delhi.

**Reference:** [en.wikipedia.org/wiki/organic-compound-03k](http://en.wikipedia.org/wiki/organic-compound-03k)  
[en.wikipedia.org/wiki/organic-chemistry-72-k](http://en.wikipedia.org/wiki/organic-chemistry-72-k)  
<http://en.wikipedia.org/wiki/physical-chemistry-28k>

**Course Name : Diploma in Chemical Engineering**

**Course code : CH**

**Semester : Third**

**Subject Title : Mechanical Operation**

**Subject Code : 17313**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04	--	04	03	100	50#	--	25@	175

**NOTE:**

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

**Rationale:**

All types of chemical industries require operations like size reduction, size separation and filtration. Different types of machinery are required to carry out such process.

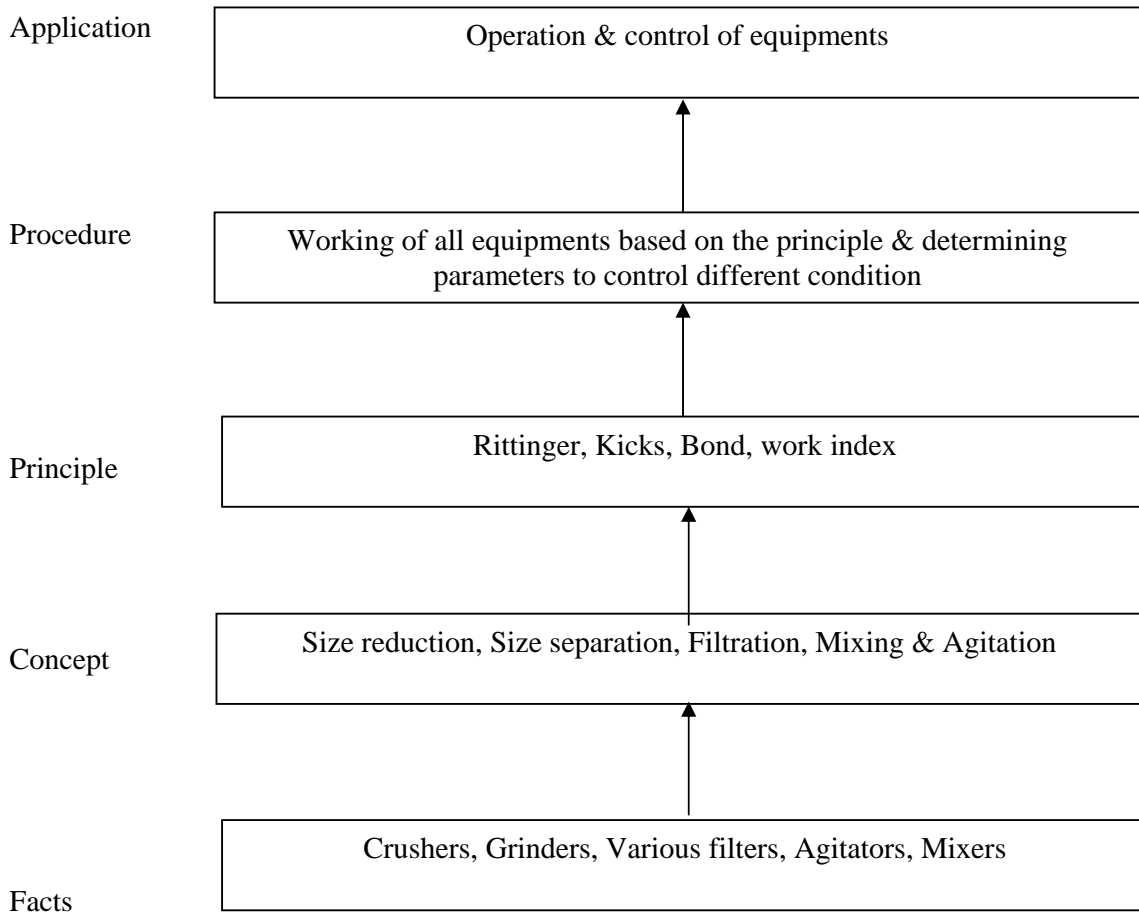
Unit operations and relevant machinery for the same is covered under mechanical operations. Knowledge of this content will be useful in operation and control of these machineries in chemical industry.

**General Objectives:**

**Students will be able to**

1. Know the various size reduction & separation equipments, its construction & working.
2. Understand working of equipment
3. Handle various equipment related to size reduction and size separation
4. Select various types of agitators, mixers

**Learning Structure:**



**Theory:**

Topic and Content	Hours	Marks
<p><b>Chapter 1: Size Reduction of Solids</b>            Specific Objectives:            ➤ Describe the construction &amp; working of size reduction equipment            ➤ Calculate power required for given size reduction operation            Contents:            1.1 (04 marks)  <ul style="list-style-type: none"> <li>• Concept of size reduction, Importance of size reduction.</li> <li>• Energy &amp; Power requirement for size reduction equipments - Rittinger's law, Kick's law, Bond law, Work index, crushing efficiency, simple problems</li> </ul>           1.2 Crushers &amp; Grinders (10 marks)  <ul style="list-style-type: none"> <li>• Classification of size reduction equipments, primary crushers, secondary crushers, grinders, cutters</li> <li>• Primary crushers : Jaw crusher</li> <li>• Secondary crushers – Gyratory crusher, Roll crushers</li> <li>• Grinders – Hammer mill, Ball mill</li> <li>• Ultrafine Grinders : Fluid energy mill,</li> <li>• Open circuit &amp; closed circuit grinding</li> <li>• Principle, construction, working and application of the above equipments</li> </ul>           1.3 (6 marks)  <ul style="list-style-type: none"> <li>• Selection of crushing rolls &amp; derivation of angle of nip. Simple problems</li> <li>• Derivation of critical speed of ball mill. Simple problems</li> </ul> </p>	14	20
<p><b>Chapter 2: Size Separation of Solids</b>            Specific Objectives:            ➤ Describe construction and working of specified screening equipments.            ➤ Determine effectiveness of screen            Contents:            2.1 (04 marks)  <ul style="list-style-type: none"> <li>• Concept &amp; Importance of screening operation</li> <li>• Classification of screens on the basis of performance (Ideal &amp; Actual screen)</li> <li>• Types of standard screen series – Tyler standard screen series, Indian standard screen series</li> <li>• Types of screen analysis – Differential analysis, cumulative analysis.</li> </ul>           2.2 Effectiveness &amp; capacity of screens – Definition, Derivation of effectiveness. Problems based on it. (06 marks)  <ul style="list-style-type: none"> <li>• factors affecting the performance of screen – Method of feed, screen surface, Moisture content, Vibration, Screen slope</li> </ul>           2.3 Types of screening equipments (06 marks)            a) Grizzlies            b) Trommel &amp; Trommel arrangements            c) Gyrotary screen            d) Shaking &amp; vibrating screen         </p>	08	16
<p><b>Chapter 3: Separation of Solid Based on Specific Properties</b>            Specific Objectives:            ➤ Describe different types of classifier</p>	12	16

<p>➤ Know Separation of solids by using specific properties.</p> <p>Contents:</p> <p>3.1 Types of size separation based on Density, Specific gravity &amp; surface properties of the materials (10 marks)</p> <p>1. Classification –</p> <ul style="list-style-type: none"> <li>• Gravity Settling Tank</li> <li>• Cone Classifier</li> <li>• Double Cone Classifier</li> <li>• Rake Classifier</li> <li>• Spiral Classifier</li> </ul> <p>3.2 Separation solid particles from liquid and gas by Cyclone separator</p> <p>3.3 Jigging</p> <p>3.4 Froth floatation</p> <p>3.5 Separation of solid particles based on electrical &amp; magnetic properties (06 marks)</p> <ul style="list-style-type: none"> <li>• Electrostatic separator</li> <li>• Separation of solid particles based on Magnetic properties</li> <li>• Magnetic head and pulley separator</li> <li>• Magnetic Drum separator</li> <li>• Ball-Norton type separator</li> </ul>		
<p><b>Chapter 4: Filtration</b></p> <p>Specific Objectives:</p> <p>➤ Describe the various filtration techniques</p> <p>➤ Describe construction and working of various types of filter Contents:</p> <p>4.1 Concept of filtration and Types of filtration (10 marks)</p> <ul style="list-style-type: none"> <li>• Cake filtration and deep bed filtration</li> <li>• Constant Rate &amp; Constant pressure filtration</li> </ul> <p style="padding-left: 40px;">Derivation based on it for batch filter</p> <p>4.2 Factors affecting the rate of filtration e.g. pressure drop, viscosity, area of filtering surface, Resistance of cake &amp; filter medium.</p> <p>4.2 Types of filtration equipments (10 marks)</p> <ol style="list-style-type: none"> <li>a) Primary filter – Sand filter (pressure sand filter and rapid sand filter)</li> <li>b) Pressure filters – Plate &amp; frame filter press (Washing type &amp; Non washing type)</li> <li>c) Vacuum filter – Rotary drum filter</li> <li>d) Centrifugal filter – Basket centrifuge</li> </ol>	14	20
<p><b>Chapter 5: Sedimentation</b></p> <p>Specific Objectives:</p> <p>➤ Describe gravity settling techniques.</p> <p>➤ Know the types of thickeners used in industry</p> <p>Contents:</p> <p>5.1 Concept &amp; Principle of sedimentation (06 marks)</p> <ul style="list-style-type: none"> <li>• Types of settling Free settling, Hindered settling</li> <li>• Concept of terminal settling velocity</li> <li>• Difference between Sedimentation &amp; Filtration Sedimentation &amp; Classification Sedimentation &amp; Centrifugation</li> </ul> <p>5.2 Laboratory batch sedimentation test &amp; setting velocity curve (Graph)</p>	08	12

(06 marks)		
<ul style="list-style-type: none"> <li>• Types of thickner- Batch thickner, continuous thickner (bridge supported)</li> <li>• Role of coagulant in filtration &amp; sedimentation</li> </ul>		
<p><b>Chapter 6: Mixing</b></p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> <li>➤ Describe homogenous &amp; heterogeneous mixtures</li> <li>➤ Identify flow patterns in mixing and agitation</li> </ul> <p>Contents:</p> <p>6.1 <span style="float: right;">(08 marks)</span></p> <ul style="list-style-type: none"> <li>• concept of mixing, homogeneous &amp; heterogeneous mixtures</li> <li>• Importance of mixing &amp; agitation</li> <li>• Construction and flow patterns of following impellers 1) propeller 2) Turbine 3) paddles</li> <li>• Flow patterns in agitated vessels in baffled tank &amp; unbaffled tank</li> <li>• Concept of swirling &amp; vortex &amp; methods of prevention of swirling &amp; vortex formation.</li> </ul> <p>6.2 Types of mixers <span style="float: right;">(08 marks)</span></p> <p>Principle, construction, working &amp; applications</p> <ol style="list-style-type: none"> <li>a) Sigma mixer</li> <li>b) Ribbon blender</li> <li>c) Banbury mixer</li> <li>d) Muller mixer</li> </ol>	08	16
<b>Total</b>	<b>64</b>	<b>100</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

1. Interpretation of result of size reduction and separation.
2. Calculating efficiency, particle size distribution etc.

**Motor Skills:**

1. Handling & operating size reduction equipments
2. Handling of vacuum pump, sedimentation, filtration, mixer
3. Plot the graphs

**List of Practicals:**

1. To determine the particle size distribution of material obtained from Jaw crusher.
2. To determine the particle size distribution of material obtained from pulveriser (Hammer mill).
3. To determine the average particle size by changing the residence time of material in ball mill.
4. To find effectiveness of screen by using any screening equipment.
5. To find efficiency of froth floatation cell.



6. Draw the rate of filtration curve by using plate and frame filter press
7. To draw rate of filtration curve using vacuum filter.
8. To carry out batch sedimentation test using different concentration of calcium carbonate slurry & find terminal settling velocity.
9. To find out solid-solid mixing index by Ribbon Blender/ Sigma Mixer.
10. To separate the given slurry using centrifuge and to determine percentage of solids recovered.

### Learning Resources:

#### 1. Books:

Sr. No.	Title	Authors	Publications
01	Unit operations of Chemical Engineering	Mccabe W. L. Smith Harrior	McGraw-Hill international - 1993
02	Chemical Engineering	J. M. Coulson J. F. Richardson J. K. Backhurst & J. H. Harker Vol. - 2	Pergamon Press 1993
03	Mechanical Operations	Anup K. Swain, Hemlata Patra, G. K.Roy	McGraw Hill Publication

#### 2. Websites: [www.crushingsolutions.com](http://www.crushingsolutions.com)

**Course Name : Diploma in Chemical Engineering****Course Code : CH****Semester : Third****Subject Title : Chemical Process Technology-I****Subject Code : 17314****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	04	03	100	50#	--	50@	200

**NOTE:**

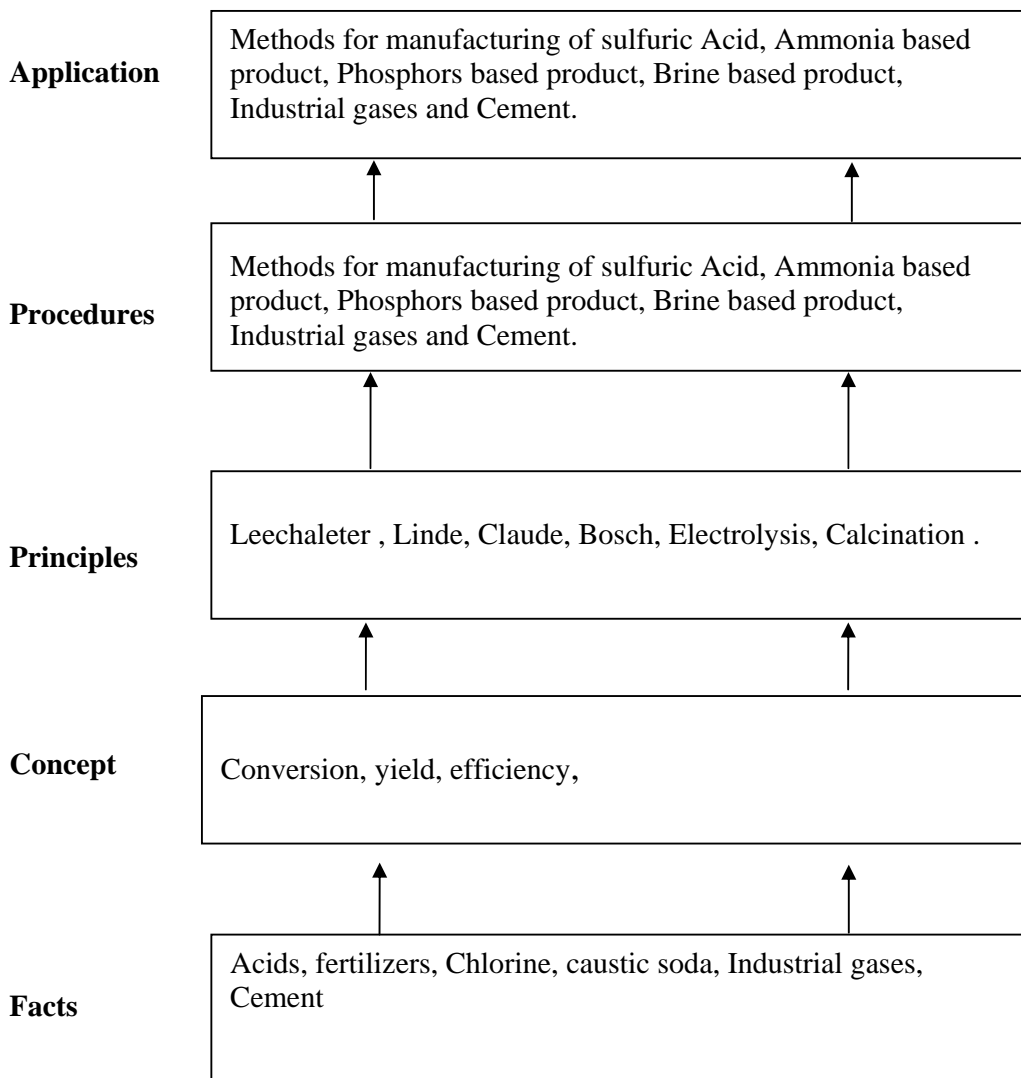
- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)

**Rationale:**

This subject will give knowledge to the students about manufacturing of various chemicals in Industries and role of the parameters like temperature, pressure, concentration and catalyst in the process.

**Objective:****The students will be able to**

1. Draw different types of flow and block diagram used in process Industries.
2. To understand the roll of reaction parameters in the process.
3. To know the uses of various chemical product manufacture in Industries.
4. Know safety precautions in chemical plants.

**Learning Structure:**

## Theory

Chapter	Topic and Contents	Hours	Marks
1	<p><b>Manufacturing of Sulfuric Acid :</b></p> <p><b>Specific Objective</b></p> <ul style="list-style-type: none"> <li>• Advantages of Contact process</li> <li>• Physico-chemical principles.</li> </ul> <p>Contents :</p> <p>1.1 Contact process (DCDA) Raw materials, Reaction, Major engineering problems, Process flow diagram, uses.</p>	04	08
2	<p><b>Manufacturing of Nitrogenous chemicals</b></p> <p><b>Specific Objectives</b></p> <ul style="list-style-type: none"> <li>• State Le Chatlier Principle</li> <li>• Importance of mixed fertilizer</li> </ul> <p><b>Contents :</b> Raw material, Reaction, Process flow diagram , Process description &amp; uses-</p> <ul style="list-style-type: none"> <li>• Ammonia,</li> <li>• Nitric Acid,</li> <li>• Urea</li> <li>• Ammonium Sulphate</li> <li>• Ammonium Nitrate</li> <li>• Ammonium Phosphate</li> </ul>	14	22
3	<p><b>Manufacturing Process of Phosphorous Chemicals</b></p> <p><b>Specific Objectives</b></p> <ul style="list-style-type: none"> <li>• Distinguish between yellow and Red phosphorus</li> <li>• Compare between single and Triple super phosphate</li> <li>• State leaching</li> </ul> <p><b>Contents:</b></p> <p>3.1</p> <ul style="list-style-type: none"> <li>• Manufacturing of Phosphorus Raw material, Reaction, Process flow diagram, Electro thermal, Electric arc process, Uses</li> <li>• Manufacturing of Phosphoric Acid Raw material, Reaction, Process flow diagram, Uses</li> </ul> <p>3.2</p> <ul style="list-style-type: none"> <li>• Manufacturing of Single Super Phosphate Raw material, Reaction, Process flow diagram, Uses, pollution control</li> <li>• Manufacturing of Triple Super Phosphate Raw material, Reaction, Process flow diagram, Uses</li> <li>• Manufacturing of Phosphorous Tri and Penta Chloride Raw material, Reaction, Block diagram, Uses</li> </ul>	16	20
4	<p><b>Chlor-alkali Industries</b></p> <p><b>Specific Objectives</b></p> <ul style="list-style-type: none"> <li>• Definition of Electrolysis</li> <li>• Define calcinations</li> <li>• Principle of absorption</li> </ul> <p><b>Contents :</b></p> <p>4.1 <span style="float: right;">12Marks</span></p> <ul style="list-style-type: none"> <li>• Manufacturing of Chlorine and Caustic soda</li> </ul>	14	20

	<p>Raw material, Diaphragm cell, Mercury cell, Cell reaction, Process flow diagram, Uses</p> <ul style="list-style-type: none"> <li>Manufacturing of Hydrochloric Acid</li> </ul> <p>Raw material, Reaction, Synthesis Process, Salt and Sulfuric Acid Process, Process flow diagram, Uses</p> <p>4.2 08Marks</p> <p>Manufacturing of Soda Ash, Raw material, Reaction, Process flow diagram, Function of Ammonization and Carbonating tower, Uses</p>		
5	<p><b>Manufacturing of Industrial Gases</b> <b>Specific Objectives</b></p> <ul style="list-style-type: none"> <li>State Linde and Claude's Principles</li> </ul> <p><b>Contents :</b></p> <p>5.1 10Marks</p> <ul style="list-style-type: none"> <li>Manufacturing of Oxygen and Nitrogen. Raw materials, Principle of Linde and Claude's Process, Block diagram, Separation process</li> <li>Manufacturing of Hydrogen by natural gas Raw material, Reaction, Process flow diagram, Uses</li> <li>Manufacturing of Water gas Raw material, Reaction, Block diagram, Uses</li> </ul> <p>5.2 10Marks</p> <ul style="list-style-type: none"> <li>Manufacturing of Producer Gas Raw material, Reaction, Block diagram, Uses</li> <li>Manufacturing of Carbon dioxide Raw material, Reaction, Manufacturing by flue gases, Process flow diagram, Uses</li> <li>Manufacturing of Acetylene Raw material, Reaction, Manufacturing by calcium carbide, Process flow diagram, Uses</li> </ul>	10	20
6	<p><b>Manufacturing of Cement &amp; other products</b> <b>Specific Objectives</b></p> <ul style="list-style-type: none"> <li>Define calcinations</li> <li>Define hardening and setting of cement</li> <li>Describe types of cement</li> </ul> <p><b>Contents :</b></p> <ul style="list-style-type: none"> <li>Manufacturing of Gypsum Raw material, Reaction, Block diagram , Uses</li> <li>Plaster of Paris-Raw material, Block diagram , Uses</li> <li>Manufacturing of Cement- Types, contents, theory of hardening and setting, raw material, wet and dry process, process flow diagram, pollution control</li> </ul>	06	10
	<b>Total</b>	<b>64</b>	<b>100</b>

**Practical:****Intellectual Skills**

- Analyze given solution
- Interpret the purity of solution.

**Motor Skills**

- Measure the purity of solution.

2. Handle the apparatus and chemicals carefully.
3. Observe chemical Reaction.

**Lists of Practicals:**

1. To find percentage purity of commercial Nitric Acid.
2. To find Nitrogen content in Fertilizer (Ammonium Fertilizer)
3. To find % purity of Sulphuric Acid
4. To find Ammonia Content in Ammonium sulphate/ Ammonium Phosphate.
5. To find percentage purity of commercial Hydrochloric acid
6. To find percentage purity of Caustic Soda.
7. Analysis of cement
8. Analysis of soda ash (Percentage Purity)
9. Analysis of Potassium Permanganate
10. Analysis of Hydrogen peroxide.
11. Analysis of bleaching powder

**Mini Project:**

Comparison of different grades of cement

Prepare Material Safety Data Sheet (MSDS) on H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>, Caustic soda, Chlorine.

Electroplating of a given metal.

**Learning Resources:****Books:**

Sr. No.	Author	Name of the Book	Publisher
1	M. Gopal Rao and Marshal Sitting	Dryden's outlines of Chemical Technology	East West
2	George Austin	Shreve's Chemical Process Industries	McGraw Hill
3	P. H. Groggins	Chemical process of Organic Synthesis	McGraw Hill

**Course Name : Diploma in Chemical Engineering**

**Course Code : CH**

**Semester : Third**

**Subject Title : Stoichiometry**

**Subject Code : 17315**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	02	--	03	100	--	--	--	100

**NOTE:**

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)

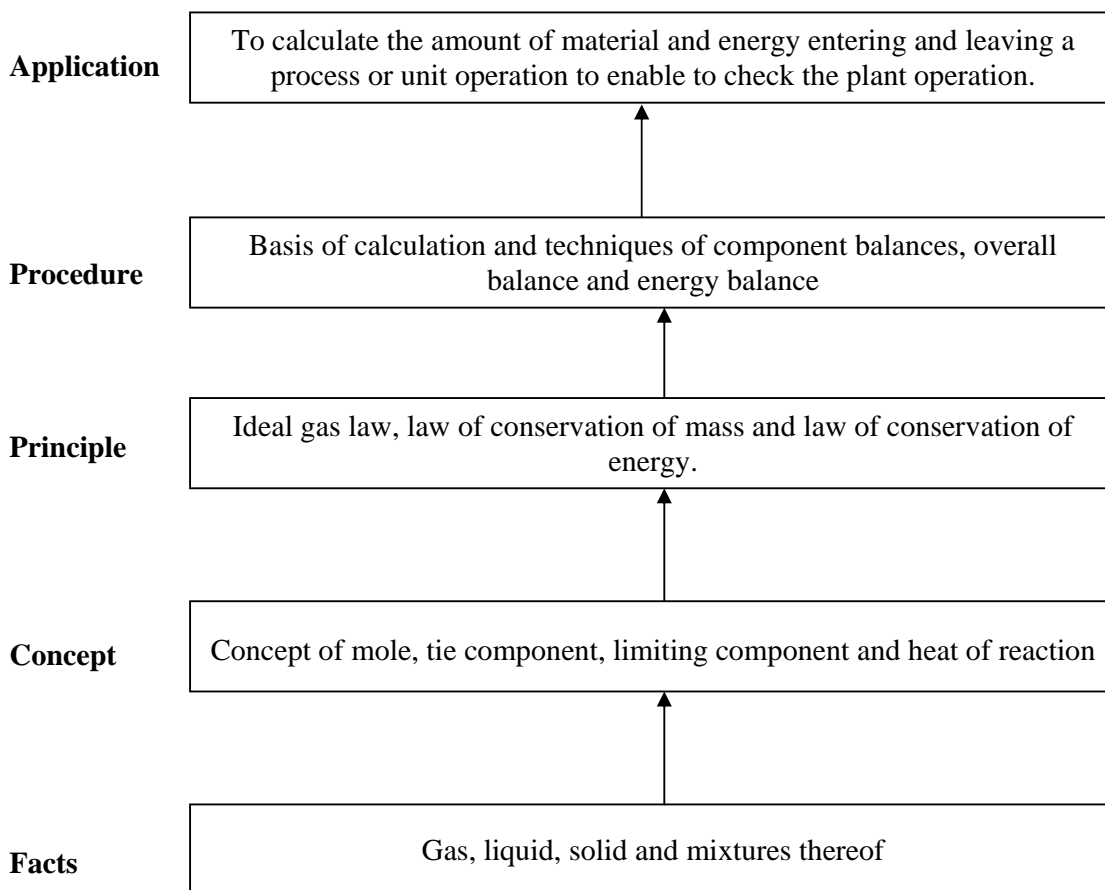
**Rationale:**

Chemical engineering is all about transformation of species of material by a chemical process and the subject stoichiometry (chemical process calculations) forms one of the core subjects of the course. It mainly deals with the qualitative and quantitative aspects of material and energy transformations during a chemical process, the knowledge of which is very essential in the design of chemical reactors, equipments and the chemical process as a whole.

**General Objectives:**

This subject will enable students to

1. Perform material balance over a given operations and process to calculate the quantity and composition of input and output streams from the process/operation.
2. Calculate the heat effects associated with a chemical reaction and unit operation.
3. Estimate material and energy requirements in a chemical process.

**Learning Structure:**



**Theory Content:**

Topic and Contents	Hours	Marks
<p><b>Topic 1: Gases, Gas mixtures &amp; Gas liquid mixtures.</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ State and explain specified gas laws.</li> <li>➤ <b>Find the average molecular wt. and density of a gas mixture.</b></li> </ul> <p><b>Contents:</b></p> <p>1.1</p> <ul style="list-style-type: none"> <li>• Ideal gas law, Dalton's law, Amagat's law,</li> <li>• Vander Waals equation of state (only concept and equation , no problems)</li> <li>• Avg. molecular wt. of a gas mixture , density of a gas mixture, composition of gas a mixture</li> </ul> <p>1.2 Raoult's law, Henry's law – statement and simple problems</p>	10	18
<p><b>Topics 2: Material balances without chemical reactions</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Describe the procedure of solving material balance problems.</li> <li>➤ <b>Calculate quantity and/or composition of entering or leaving stream of an operation.</b></li> </ul> <p><b>Contents:</b></p> <p>2.1 <b>04 Marks</b></p> <ul style="list-style-type: none"> <li>• Law of conservation of mass.</li> <li>• Definition &amp; block diagram of various unit operations such as drying, evaporation, crystallization, extraction, distillation, absorption, filtration, etc.</li> </ul> <p>2.2 Solving material balance problem in distillation, drying, evaporation operations <b>16 Marks</b></p> <p>2.3 Solving material balance problem in crystallization, extraction, absorption, filtration, mixing &amp; blending. Recycling &amp; bypassing operations <b>12 Marks</b></p> <p>(Note : No problems on recycling &amp; bypass operations)</p>	15	32
<p><b>Topic 3 : Material Balance with chemical reactions</b></p> <p><b>Specific Objectives:</b></p> <ul style="list-style-type: none"> <li>➤ Identifying limiting and excess components</li> <li>➤ Know about the procedure of solving material balance problems without chemical reactions</li> <li>➤ <b>Calculate % conversion, %yield, %excess, raw material requirements, etc.</b></li> </ul> <p><b>Contents:</b></p> <p>3.1 Definition &amp; terms <b>04Marks</b></p> <ul style="list-style-type: none"> <li>• Stoichiometric equation, stoichiometric co-efficient, stoichiometric ratio.</li> <li>• Limiting component, excess component, conversion, yield, selectivity &amp; % excess</li> </ul> <p>3.2 Solving material balance problems with chemical reactions for calculating % conversion, %yield, %excess, of raw materials or products. <b>16 Marks</b></p> <p>3.3 Solving material balance problems with fuels &amp; combustion reaction for</p>	13	32

calculating percent excess air	<b>12 Marks</b>		
<b>Topic 4: Energy Balance</b> <b>Specific Objectives:</b> <ul style="list-style-type: none"> <li>➤ Calculate standard heat of reaction using heat of formation &amp; heat of combustion data.</li> <li>➤ <b>Calculate the heat effects associated with a chemical reaction.</b></li> </ul> <b>Contents:</b>			
4.1 <ul style="list-style-type: none"> <li>• Law of conservation of energy, different forms of energy, heat/thermal energy &amp; its units.</li> <li>• Sensible heat, latent heat, specific heat, heat capacity, heat capacity at constant volume, and at constant pressure, variation of heat capacity with temp. Equation for calculating the sensible heat requirement using heat capacity data.</li> </ul> 4.2 Standard states for gas, liquid & solid. Heat of formation, heat of combustion, heat of reaction, Hess's law of constant heat summation and its application. Heat of dilution & dissolution. <ul style="list-style-type: none"> <li>• Effect of temp. on heat of reaction, relationship for calculating the heat of reaction at any temp. Heat effects associated with chemical reactions (endothermic and exothermic).</li> <li>• Adiabatic operations, adiabatic reaction &amp; adiabatic reaction temp. (only definitions)</li> </ul>		10	18
<b>Total</b>		<b>48</b>	<b>100</b>

**List of Assignments (Tutorial):**

Assignments	Hours
1. Problems on Ideal Gas Law	03
2. Problems on average molecular weight, density and composition of a gas mixture.	03
3. Material balance problems on drying, extraction.	02
4. Material balance problems on distillation, absorption.	03
5. Material balance problem on mixing, evaporation.	02
6. Material balance problems on filtration, crystallization.	02
7. Material balance problem with Chemical Reactions for calculating % excess, % conversion, % yield.	04
8. Material balance problems with Chemical Reaction for calculating % composition of feed/ product stream on mole basis and weight basis.	04
9. Sensible heat transfer calculations using heat capacity data.	02
10. Heat of formation of a compound using Hess law.	02
11. Calculate the standard heat of reaction using heat of formation and heat of combustion data.	01
12. Calculate the heat transferred using latent heat data, specific heat data.	02
13. Calculate the heat effects associated with a chemical reaction.	02
<b>Total</b>	<b>32</b>

**Learning Resources:**

**Books:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publisher</b>
1	Stoichiometry	Bhatt. B. I & Vora. S. M	Tata Mc Graw Hill Publication, New Delhi
2	Basic principle & calculations in chemical engineering	David M, Himmelblau & Riggs	Prentice Hall of India Pvt. Ltd., New Delhi
3	Chemical Process Principles	Hougen & Watson	Wiley Estern Ltd., New Delhi

**Course Name : Diploma in Chemical Engineering****Course Code : CH****Semester : Third****Subject Title : Professional Practices-I****Subject Code : 17019****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	03	--	--	--	--	50@	50

**Rationale:**

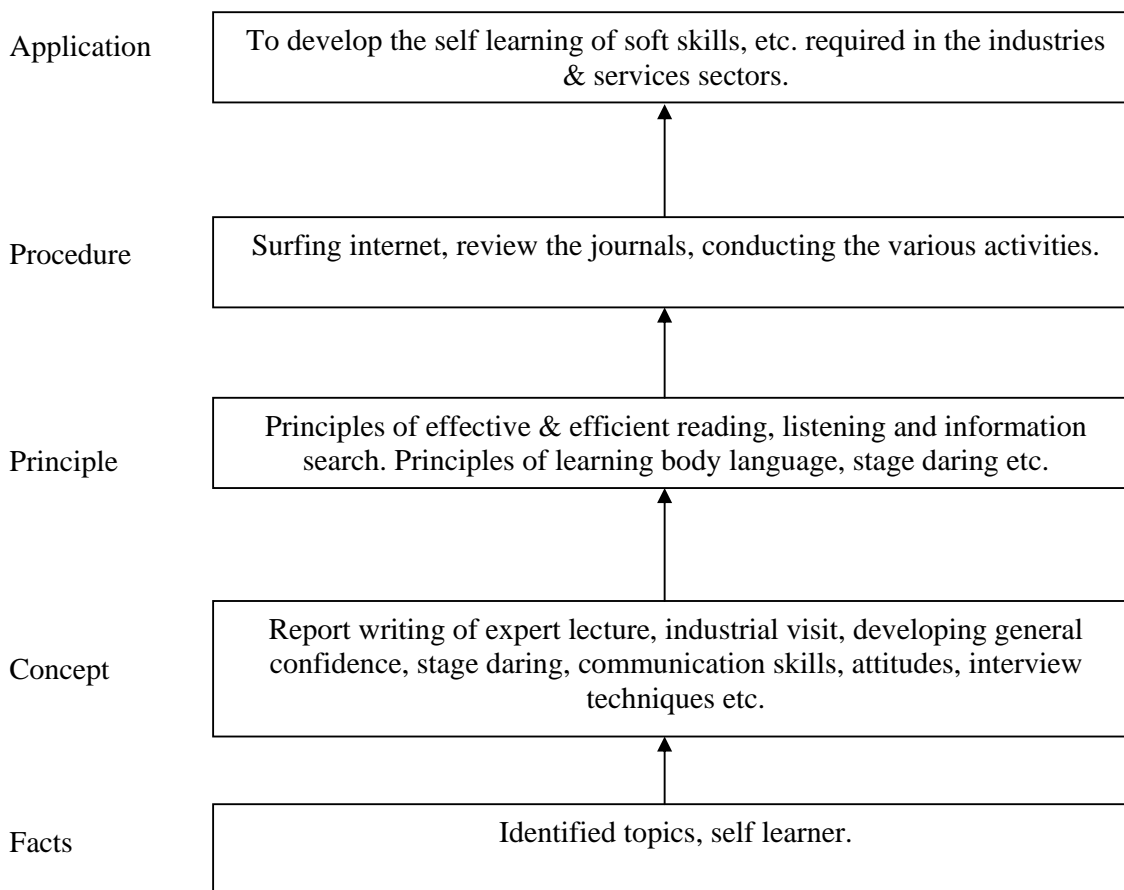
Most of the diploma holders in industries lack in soft skills such as communication skills, interview techniques, personality developments etc. The selection for the job of diploma holders is based on competitive tests, interviews and/or group discussions. Therefore while selecting candidates a normal practice adopted is to see general confidence, ability to communicate and their attitude, in addition to basic technological concepts.

The purpose of introducing professional practices is to provide opportunity to students to undergo the activities which will enable to develop the skills through industrial visits, expert lecturers, seminars, group discussions.

**General Objectives**

Student will be able to:

1. Acquire information from different sources.
2. Prepare notes for given topic.
3. Present given topic in a seminars.
4. Present given topic in group discussion.
5. Interact with peers to share thoughts.
6. Prepare a report on industrial visits, expert lectures.

**Learning Structure:****Guidelines for implementing professional practices**

- In order to implement contents of professional practice effectively it is necessary for the department to plan the activities for full semester. Minor modifications may be done if required. Following are guidelines for the same.
- Activities to be guided and monitored by the faculty of the concerned department only.
- Involve students in related activities to a great extent to develop learning to learn skills.
- Arrange industrial visits and expert lectures on convenient days. Periods of PP may be allocated to concerned faculty members whose periods may be lost.

Ensure to carry out all activities suggested.

**Contents: Theory**

Sr. No.	Activities	Hours
01	<p><b>Industrial Visits :</b> Industrial visits to be arranged and report of the same should be submitted by individual student as a part of term work. Visit any two chemical industries available in surrounding areas.</p> <p><b>Relevant Content of report :</b> Name of industry, industry profile, history, organisation structure, application of products, raw materials &amp; its sources, reactions unit operation</p>	12
02	<p><b>Expert Lectures :</b> Minimum two expert lectures based on chemical engg. field to be arranged for the students and the report to be prepared and submitted by individual student as a part of term work. Selection for topics for expert lectures to be related with fundamental of chemical engineering, mechanical operations, chemical technologies etc. Some of the suggested topics are :</p> <ol style="list-style-type: none"> <li>i. Scope for chemical engineers.</li> <li>ii. Scenario types &amp; nature of chemical industries.</li> <li>iii. Recent developments in chemical industries.</li> <li>iv. Any other topics.</li> </ol>	08
03	<p><b>Seminar / Paper Presentation :</b> Students should present a paper or a seminar on a given topic related with the learning relevant subjects, topics for seminar may be selected from following chemical journals</p> <ol style="list-style-type: none"> <li>i. Chemical product finder</li> <li>ii. Chemical weekly</li> <li>iii. Chemical industry digest etc.</li> </ol> <p>The report should be written and submitted in advance in a specific format of seminar and presented for 6 to 8 min. with question &amp; answer session for 2 to 3 min. by each individual student. Major weightage is to be given for this activity.</p>	14
04	<p><b>Group Discussion :</b> Student should discuss in a group of six to eight and to be monitored by faculty member. The student should write a brief report on the same and submit as a part of term work.</p> <p><b>Some of the suggested topic are :</b></p> <ol style="list-style-type: none"> <li>i. Current topics related to chemical industry.</li> <li>ii. Application of computer in chemical engineering field.</li> <li>iii. Safety in Chemical industries</li> <li>iv. Any other topics</li> </ol>	08
05	<p><b>Collection of materials / products / processes :</b> The students group of 3 to 4 will perform any one of the following activities.</p> <ol style="list-style-type: none"> <li>i. Collect samples of five basic fertilizers.</li> <li>ii. Collect minimum three samples of mixed fertilizers, micronutrients, organic fertilizers etc.</li> <li>iii. Collect five organic/inorganic chemicals.</li> </ol> <p>The report should content the uses, manufacturer's name, packaging, properties, etc. with samples, it is to be submitted as a part of term work.</p>	06
<b>Total</b>		<b>48</b>