 MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																
COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING																
COURSE CODE : CH																
DURATION OF COURSE : 6 SEMESTERS										WITH EFFECT FROM 2012-13						
SEMESTER : FOURTH										DURATION : 16 WEEKS						
PATTERN : FULL TIME - SEMESTER										SCHEME : G						
SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME									SW (17400)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)		
								Max	Min	Max	Min	Max	Min	Max	Min	
1	Physical Chemistry and Materials of Construction	PCM	17423	03	--	02	03	100	40	--	--	--	--	25@	10	50
2	Electrical and Electronics	EAE	17424	04	--	02*	03	100	40	--	--	--	--	25@	10	
3	Plant Utility	PUT	17425	03	--	02	03	100	40	--	--	--	--	25@	10	
4	Fluid Flow Operation	FFO	17426	03	--	04	03	100	40	50#	20	--	--	25@	10	
5	Chemical Process Technology-II	CPT	17427	03	--	04	03	100	40	50#	20	--	--	25@	10	
6	CAD Software	CSO	17039	--	--	02	--	--	--	--	--	--	--	25@	10	
7	Professional Practices-II	PPT	17040	--	--	03	--	--	--	--	--	--	--	50@	20	
TOTAL				16	--	19	--	500	--	100	--	--	--	200	--	50
**	Industrial Training (Optional)			Examination in 5th Semester Professional Practices-III												
Student Contact Hours Per Week: 35 Hrs. THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH. Total Marks : 850 @ - Internal Assessment, # - External Assessment, No Theory Examination, * - Practicals of Electrical & Electronics at alternate week. Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work. ** Industrial Training (Optional) - Student can undergo Industrial Training of four weeks after fourth semester examination during summer vacation. Assessment will be done in Fifth semester under Professional Practices-III. They will be exempted from activities of Professional Practices-III of 5th Semester. <ul style="list-style-type: none"> ➤ 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. ➤ For CAD software subject MSBTE should decide the contents of the practical every year through identified experts and ensure that these practicals only performed in the institute. 																

Course Name : Diploma in Chemical Engineering**Course Code : CH****Semester : Fourth****Subject Title : Physical Chemistry and Materials of Construction****Subject Code : 17423****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	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).**

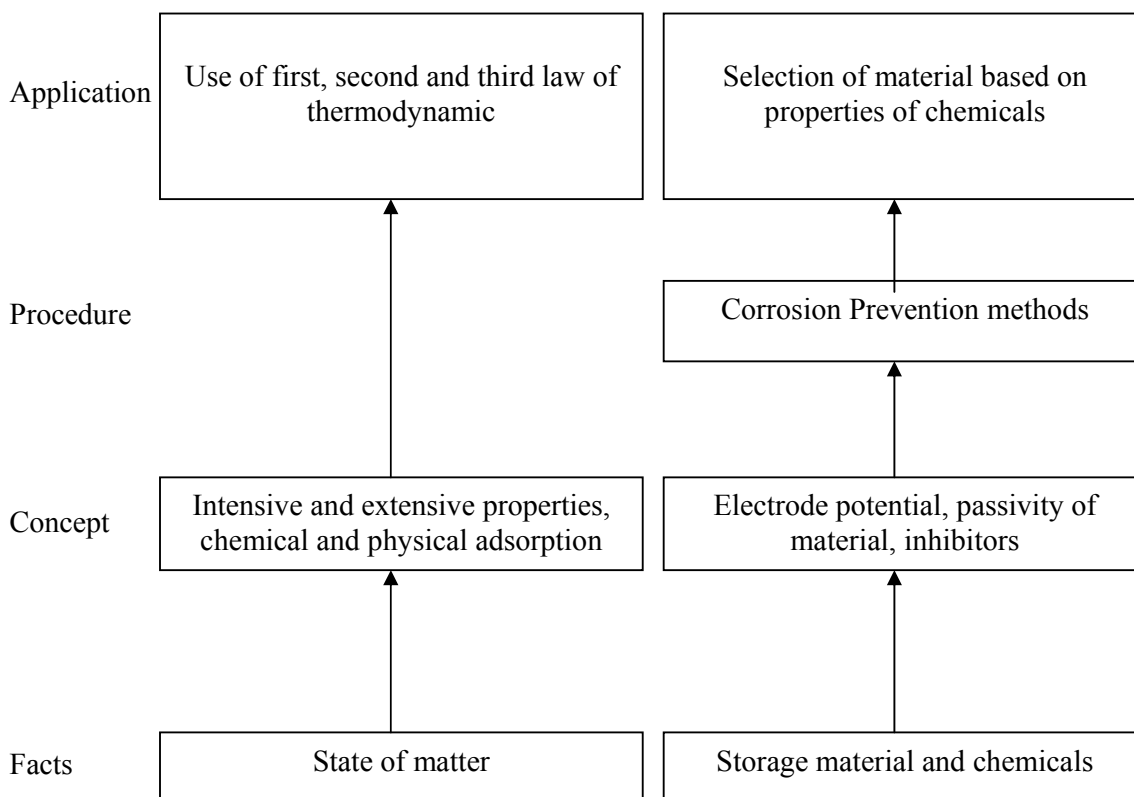
Rationale:

Different chemicals are used in industries to manufacture a desired product. Various reactions are used for manufacturing desired chemicals. These processes depend upon basic concepts of thermodynamics. Contents of this subject will enable the students to understand thermodynamic concepts which are required during kinetic study.

Storage tank, material handling equipment and reactors require careful selection of material of construction. The material of construction should be compatible with chemicals to be handled. The content of this subject will enable the students in understanding types of corrosion, classification of engineering materials and criteria for selection of material of construction.

General Objectives:**Students should be able to:**

1. Understand basic concepts of thermodynamics & it's laws.
2. Determine degree of freedom of a given system.
3. Understand concepts of adsorption and its application in chemical industry.
4. Select material of construction for specific chemicals.

Learning Structure:

1.1 Theory: marks)

- Scope of thermodynamics

Chapter	Topic and Contents	Hours	Marks
1	<p>Topic 1: Thermodynamics Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Differentiate between intensive & extensive properties ➤ State applications of laws of thermodynamics <p>Contents:</p> <p>1.2 Concepts of thermodynamics (08 Definitions) : System, Surroundings, Boundary</p> <ul style="list-style-type: none"> • Homogeneous & Heterogeneous systems • Types of thermodynamic systems - Isolated system, open system, closed system • Intensive & extensive properties • Thermodynamic states Equilibrium state, Non equilibrium state <p>Standard states -solid, liquid & gases</p> <p>1.2 Thermodynamic processes (06 marks)</p> <ul style="list-style-type: none"> • Isothermal process, Adiabatic process, Isobaric process, Isochoric process, Cyclic process. • Reversible & Irreversible process. • Difference between Reversible & irreversible process <p>Internal energy.</p> <p>1.3 Basic laws of thermodynamics - (10 marks)</p> <ul style="list-style-type: none"> • pressure, volume, work and their expressions • Statement of First law of thermodynamics • Definition and Expression of Enthalpy of system, Adiabatic & isothermal expansion of Gasses. • Statement of Second law of thermodynamic • Statement of third law of thermodynamics, , Zeroth law 	10	24
2	<p>Topics 2: Phase Rule Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Determine degree of freedom of given system ➤ State phase rule <p>Contents:</p> <ul style="list-style-type: none"> • Phase rule statement, Phase components • Degree of freedom • Derivation of phase rule • The water system, the sulphur system 	04	10
3	<p>Topics 3: Adsorption & Colloids Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Give example of adsorption ➤ Describe adsorption isotherm <p>Contents:</p> <p>3.1 Adsorption (12 Marks)</p> <ul style="list-style-type: none"> • Definition, example, Mechanism of adsorption • Types of adsorption 	10	20

	<p>Physical adsorption, chemical adsorption, difference between physical & chemical adsorption</p> <ul style="list-style-type: none"> • Adsorption isotherm: Freundlich adsorption isotherm, Langmuir adsorption isotherm • Application of adsorption <p>3.2 Colloids : (08 Marks)</p> <ul style="list-style-type: none"> • Definition • Types of colloidal system - Lyophilic, Lyophobic colloids (solution) its characteristics & comparison • Methods of preparation of colloids (solution) 		
4	<p>Topics 4: Corrosion</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State types of corrosion ➤ Corrosion prevention and control methods <p>Contents:</p> <p>4.1 Types of corrosion (14 Marks)</p> <ul style="list-style-type: none"> • Definition • Types of corrosion <ul style="list-style-type: none"> ➤ Dry corrosion – Formation of protective films, Growth of oxidation film. ➤ Wet corrosion • Meaning of the terms Electrode potential, Electrochemical series, Galvanic cell, Galvanic series, potential difference • Process of corrosion. • Effect of temperature on corrosion • Specific types of corrosion such as Uniform corrosion, pitting corrosion, galvanic corrosion, oxidation corrosion, inter granular corrosion, selective corrosion, erosion corrosion, fretting corrosion <p>4.2 Corrosion prevention and control (10 Marks)</p> <ul style="list-style-type: none"> • Corrosion prevention methods - <ul style="list-style-type: none"> Use of high purity metals Use of alloy additions, Special heat treatment • Corrosion protection methods <ul style="list-style-type: none"> Use of inhibitors, Electro-chemical protection, protective coatings • Effect of pH value on corrosion • Caustic embrittlement 	12	24

5	Topics 5 : Material of construction and their properties Specific Objectives: ➤ Select compatible material for storage of chemicals Contents: 5.1 Common Materials (14 Marks) <ul style="list-style-type: none"> • Classification of engineering materials • Selection of material of construction based on properties of chemicals. • Commonly used material of construction – composition of materials and its specific use : cast iron, carbon steel – mild steel, stainless steel – SS304, SS316, SS314, alloys of aluminium, PVC, Teflon, Polypropylene, Polyethylene 5.2 Special Materials (08 Marks) <ul style="list-style-type: none"> • Lining and its importance • Rubber lining, Glass lining, Lead lining, Plastic lining 	12	22
	Total		

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

- 1) Verify the laws and characteristics.
- 2) Analyze given solution and study its thermodynamic properties.
- 3) Understand the set up of experiment.

Motor Skill:

- 1) Observe the completion of reaction.
- 2) Handle various laboratory reagents.
- 3) Accurately measure proper quantity of various chemicals.

List of Practicals:

- 1) To measure the heat of combustion off methyl alcohol and ethyl alcohol.
- 2) To determine the heat of neutralization of acid and alkali.
- 3) Determination of melting point of solid substance.
- 4) Determination of boiling point of liquid.
- 5) Purification of solids by crystallization(potassium chloride and potassium chlorate)
- 6) Verification of the freundrich isotherm in adsorption of acetic acid, benzoic acid by activated charcoal.
- 7) Determination of partition coefficient.

Learning Resources:**1. Books:**

Sr. No.	Author	Title	Publisher
01	B. S. Bahal, G. D. Tuli, Arun Bahal	Essential of Physical Chemistry	S. Chand
02	J. M. Coulson & J. F. Richardson	Chemical Engineering Vol. 6	Asian Books Pvt. Ltd.
03	Contributors	Engineering Chemistry	Wiley India
04	B.R.Puri, L.R.Sharma, Madan s, Puthania	Principles of Physical chemistry	S.Chand & company

Course Name : Diploma in Chemical Engineering/ Plastic Engineering

Course code : CH / PS

Semester : Fourth

Subject Title : Electrical and Electronics

Subject Code : 17424

Teaching and Examination Scheme:

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

* - Practicals of Electrical & Electronics at alternate week.

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:

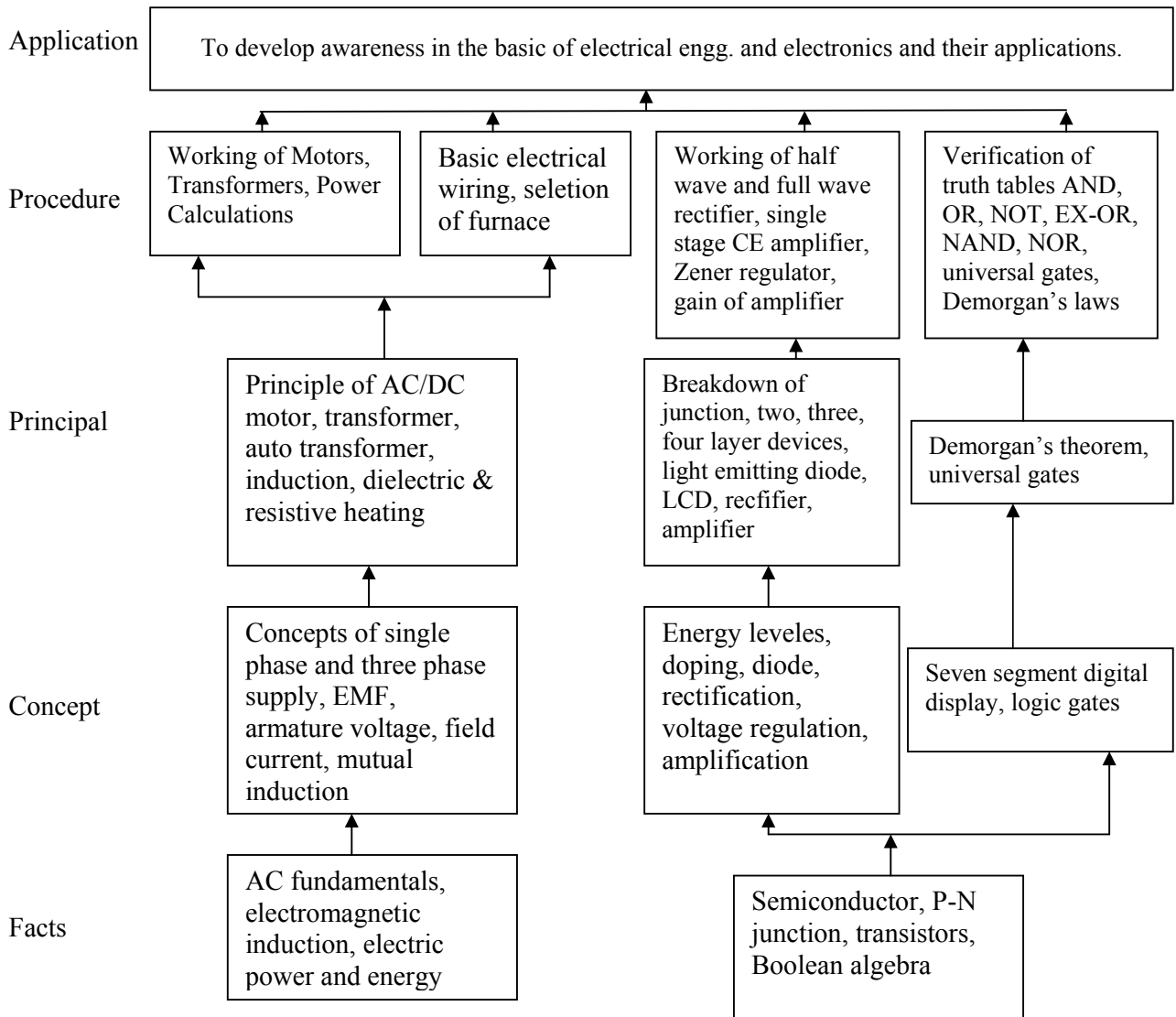
Most of the equipments used in chemical industry are electrically powered. A minor electrical faults can be attended by a shop floor chemical engineer. This subject of electrical engg. addresses the fundamental concepts and operating principles of electrical appliances. It will enable the students in better handling and commissioning of the equipments.

The second section of the subject deals with the basic of semiconductor devices and their circuits necessary for the electronic control gadgets. It provides the information about logic gates, digital displays, small signal amplifiers and power supplies. This will help the students in building skills of effective handling of electronic control equipments.

General Objectives: Student will be able to develop:

- Awareness of Electrical Safety.
- Recognize Electrical fault in Chemical Plant.
- Recognize fault in power supply, display & control panel.
- Understand working of basic semiconductor devices.

Learning Structure:



Theory:

Section- I

Electrical Engineering

Topic and Content	Hours	Marks
<p>Topic 1: Basic Fundamentals</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State principle of electromagnetic induction. ➤ Calculate electrical power and energy from given data. <p>Contents:</p> <ul style="list-style-type: none"> • Ohm's Law – Simple problems on Ohm's Law • Types of supply – A.C. & D.C., definition, representation & comparison. • Principle of electromagnetic induction. • Concept of single Phase & Three Phase A.C. supply, comparison. • Electrical power, energy – definition, equation, simple problems. • Power factor & its importance 	07	10
<p>Topics 2: D.C. Motor</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Draw electrical circuit diagram of D.C. shunt motor. ➤ Draw diagram & explain armature voltage speed control method. <p>Contents:</p> <ul style="list-style-type: none"> • Working principle, construction, different parts – their material & application. • Types of D.C. motor – Electrical circuit of D.C shunt & series motor. • Speed control of D.C Shunt & Series motor. • Necessity of starter & its principle. • Applications of D.C. motors related to chemical plant. 	06	10
<p>Topics 3: A.C. Motor</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Draw electrical circuit diagram of R – Split single phase induction motor. ➤ State any four parts & their material used for three phase induction motor. <p>Contents:</p> <ul style="list-style-type: none"> • Three phase induction motor – working principle, construction & application. • Construction, working & application of following single phase induction motors. R – Split, C – Split. 	05	08
<p>Topics 4: Transformer</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Compare core type & shell type transformer. ➤ Define voltage ratio, current ratio & transformation ratio of single phase transformer. <p>Contents:</p> <ul style="list-style-type: none"> • Working principle of transformer, Elementary theory of an ideal transformer. 	06	10

<ul style="list-style-type: none"> • Construction of core & shell type transformer, comparison. • EMF equation (No Derivation), simple problems. • Transformation ratio – simple problems. • Autotransformer – Concept, advantages, limitations, applications. 		
<p>Topics 5: Electrical Wiring & Safety</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State the necessity of fuse. ➤ State the necessity of earthing. <p>Contents:</p> <ul style="list-style-type: none"> • Types of wires – V.I.R. , P.V.C. ,T.R.S., Specifications as per IS code. • Fuse – Necessity, kit-kat & HRC fuse - construction, working. • Circuit breakers – MCCB, ELCB, principle & application. • Electrical wiring – one lamp controlled by single way switch, two lamp controlled by two single way switches (independently), stair case wiring, godown wiring. • Lamps – Incandescent lamp, fluorescent lamp, mercury vapour & sodium vapour lamp - construction, application. • Electrical safety – Safety precautions, Instruction for restoration of persons suffering from electric shock. • Earthing – Need, Types – plate & pipe 	08	12
Total	32	50

Section- II Electronics

Topic and Content	Hours	Marks
<p>Topic 1: Semiconductor Electronic Devices</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Draw V-I characteristics of different devices. ➤ State the symbols of different components. <p>Contents:</p> <p>1.1 ----- 12 Marks</p> <ul style="list-style-type: none"> • Resistor, inductor, capacitor – definition, symbols & applications. • Conductors, semiconductors, Insulators – definition, energy band diagram, examples. • Semiconductors classification – Intrinsic and Extrinsic – N type & P type, definition, charge carrier. • PN junction diode – construction, symbol, working, forward & reverse bias V-I characteristic, applications. • Light emitting diode – Construction, symbol, working principle, applications. • Junction breakdown. • Zener diode - Construction, symbol, working principle, reverse bias V-I characteristic, applications. <p>1.2 Power devices - (08 marks)</p> <p style="padding-left: 40px;">SCR - Construction, symbol, working principle, Applications.</p> <p style="padding-left: 40px;">TRIAC - Construction, symbol, working principle, Applications.</p>	12	20
<p>Topics 2: Bipolar Junction Transistor</p> <p>Specific Objectives:</p>	06	08

<ul style="list-style-type: none"> ➤ Draw output characteristics of CE configuration. ➤ Describe working of transistor amplifier. <p>Contents:</p> <ul style="list-style-type: none"> • BJT types – NPN & PNP , their symbols & construction, • Working of a NPN transistor. • Transistor characteristics – Common emitter configuration. • Single stage CE amplifier – circuit diagram & working. • Power amplifier – Concept & types. • Applications of transistor. 		
<p>Topics 3: Power Supply</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Draw block diagram of power supply. ➤ Describe working of different rectifier circuits. <p>Contents:</p> <ul style="list-style-type: none"> • Power supply – Necessity, block diagram. • Rectifier – Types, Half wave, Full wave (center tapped & bridge type) - Circuit diagram, working, waveforms & their comparison. • Filter - Need & types – shunt capacitor, series inductor, LC & π type, circuit diagram. • Voltage regulator - Need, principle of zener shunt regulator. 	07	12
<p>Topics 4: Digital circuits</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State symbols of different logic gates. ➤ Use NAND / NOR gate as universal gates. <p>Contents:</p> <ul style="list-style-type: none"> • Digital signal, Negative & positive logic. • Boolean algebra. • Logic gates – AND, OR, NOT, NAND, NOR, EX-OR , Symbols, logic expressions ,truth table. • De- Morgan,s theorems – statement, proof using truth table. • Universal gates – definition, NAND, NOR. <p>Digital display – Types of LED & LCD display</p>	07	10
Total	32	50

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

- Correlate speed of the motor with its other parameters.
- Identify the simple faults in electrical and electronics systems.

Motor Skills:

- Use various tools and components for different electrical applications.
- Handle various electronic test and measuring equipments.

List of Practicals:**Section-I**

- 1) To verify ohm's law.
- 2) To measure electrical Power in Single phase AC circuit.
- 3) To plot the Speed & Armature voltage characteristics of DC shunt motor.
- 4) To plot the Speed & field current characteristics of DC shunt motor.
- 5) To determine transformation ratio of single phase transformer.
- 6) To prepare wiring for one lamp controlled by Single way switch.

Section-II

- 1) To operate the various laboratory equipments & measuring instruments like power Supply, CRO, DMM.
- 2) To plot forward & reverse characteristics of Silicon Diode.
- 3) To measure percentage line regulation of Shunt Zener regulator.
- 4) To measure voltage gain of single stage common Emitter amplifier at 1 khz.
- 5) To verify the truth tables of various logic gates.
- 6) To verify De - Morgan's First theorem.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	B.L. Theraja	Electrical Technology Vol. 1 & 2	S.Chand & Company Ltd.
2	S.L. Uppal	Electrical Power	Khanna Publishers, Delhi.
3	N.N. Bhargava, S.C. Gupta	Basic Electronics & Linear N.N. Bhargava, Technical Teachers Circuits	Technical Teachers Training Institute
4	B.L. Theraja	Basic Electronics (Solid State)	S.Chand & Company Ltd.
5	R.P. Jain	Modern Digital Electronics	Tata Mc Graw Hill, Delhi.
6	B.D.Arora	Electrical Wiring & Estimation Costing	R.B. Publications

Course Name : Diploma in Chemical Engineering**Course Code : CH****Semester : Fourth****Subject Title : Plant Utility****Subject Code : 17425****Teaching and Examination Scheme:**

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

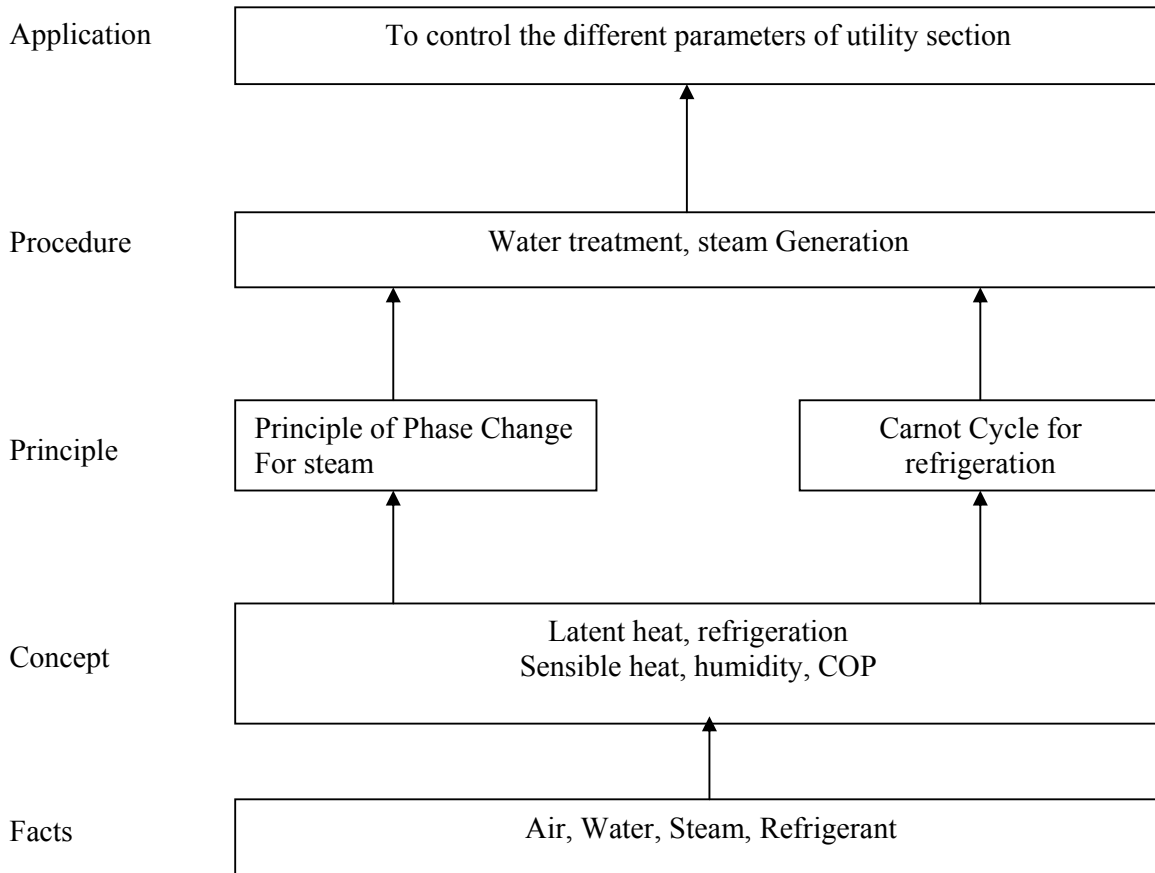
This subject covers the requirement of different utilities for the process plant, along with its generation and its effective utilization. Main utilities required for process plants are water, steam, air & refrigerants. Steam & non- steam heating media are important for conversion of raw material to products in reactors & to elevate the temperature in the chemical processes. Refrigeration is important to maintain the temperature in the process plant. Compressed air, process air is used in processes & instrument air is used in pneumatic devices & controls.

General Objectives:

The student will be able to:

1. State the principles involved during water treatment, generation of steam and refrigeration cycles.
2. Select the different equipments used to run the process plant with different utilities.
3. Understand basic calculation involved in steam generation, psychometric operation and refrigeration.

Learning Structure:



Theory Content:

Topic and Contents	Hours	Marks
<p>Chapter 1 : Water</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Describe the methods of water treatment ➤ Explain the problem occurred in Boiler feed water <p>Contents:</p> <p>1.1 (08 Marks)</p> <ul style="list-style-type: none"> • Sources of water, hard and soft water, • Requisites of industrial water and its uses • Methods of water treatment- Chemical softening, Demineralization <p>1.2 (12 Marks)</p> <ul style="list-style-type: none"> • Resins used for water softening • Reverse osmosis and membrane separation • Problems in boiler feed water & its treatments- Scale & sludge formation, Corrosion, Priming & foaming, Caustic embrittlement 	10	20
<p>Chapter 2 : Refrigeration</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State the different properties of Refrigerants ➤ Describe the different Refrigeration system <p>Contents:</p> <p>2.1 (12 Marks)</p> <ul style="list-style-type: none"> • Definition of Ton of refrigeration and coefficient of performance. • Refrigeration cycles • Different methods of refrigeration used in industry- Vapour compression, Vapor absorption, Air refrigeration. <p>2.2 (12 Marks)</p> <ul style="list-style-type: none"> • Different refrigerants- Lithium bromide (eco-Friendly) Monochlorodifluoro methane (R-22), Carbon di oxide, Ammonia. Secondary refrigerants: Brine, water and air: Properties and applications of above. • Simple calculation of C.O.P. 	11	24
<p>Chapter 3 : Steam and Steam Generation</p> <ul style="list-style-type: none"> ➤ Calculate Enthalpy of different types of steam ➤ Explain Principle, construction & working of Boiler. <p>Contents:</p> <p>3.1 (12 Marks)</p> <ul style="list-style-type: none"> • Properties of steam • Problems based on enthalpy calculation for wet steam, dry saturated steam, superheated steam <p>3.2 (18 Marks)</p> <ul style="list-style-type: none"> • Types of steam generator / boilers: water tube & fire tube Solid fuel fired boiler, waste gas fired boiler, Waste heat boiler. Fluidized bed boiler • Scaling, trouble shooting, preparing boiler for inspection • Boiler mountings and accessories: principle of operation, construction and working. (water level indicator, pressure gauge, steam trap, pressure reducing valve, economizer, preheater, super heater) • Boiler Act 	14	30
<p>Chaper 4 : Psychrometry</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State properties of air-water system 	08	16

<ul style="list-style-type: none"> ➤ Describe Humidification & Dehumidification process Contents: <ul style="list-style-type: none"> • Properties of Air-water vapours. • Use of humidity chart • Equipment used for humidification, Evaporative cooling, spray ponds, cooling towers , their Construction ,working and application 		
Chapter 5 : Air Specific Objectives: <ul style="list-style-type: none"> ➤ State the applications of air. ➤ Explain the process of getting instrument air Contents: <ul style="list-style-type: none"> • Use of Compressed air, process air and instrument air • Single, multistage compression, Interstage coolers • Process of getting instrument air. 	03	06
Chapter 6 : Non steam heating system Specific Objectives: <ul style="list-style-type: none"> ➤ State the temperature ranges of Non steam heating system ➤ Explain Principle, Construction & Working of Non steam heating system. Contents: Principle, construction and working of : <ul style="list-style-type: none"> • Thermic fluid heater • Types of thermic fluid and their temperature ranges. 	02	04
Total	48	100

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

1. Analysis of water.
2. Calculation of humidity & use of humidity chart
- 3 Calculation of heat load in cooling tower
4. Interpretation of steam data using steam table.

Motor Skills:

1. Handling of pH meter, TDS meter
2. Handling of thermo pack or boiler
3. Handling of Reverse Osmosis system
- 4 Handling of cooling tower

List of Practicals:

1. To determine the alkalinity of water.
2. To determine the hardness of water.
3. To determine the pH using pH meter.
4. To determine humidity by using whirling psychrometer/sling psychrometer.
5. To observe the operations of boiler / thermo pack using simulator.
6. To determine outgoing temperature of water from any cooling tower.
7. To analyse RO water based on TDS, pH & hardness
8. To measure different pressures of compressed air.
9. To read / interpret different properties of steam using steam table.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
01	P. L. Balleney	Thermal Engineering	Khanna Publisher, New Delhi
02	S.T. Powel	Industrial Water Treatment	McGraw Hill, Newyork
03	Jain & Jain	Engineering Chemistry	--
04	B.K. Sarkar	Thermal Engineering	--

Course Name : Diploma in Chemical Engineering**Course Code : CH****Semester : Fourth****Subject Title : Fluid Flow Operation****Subject Code : 17426****Teaching and Examination Scheme:**

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

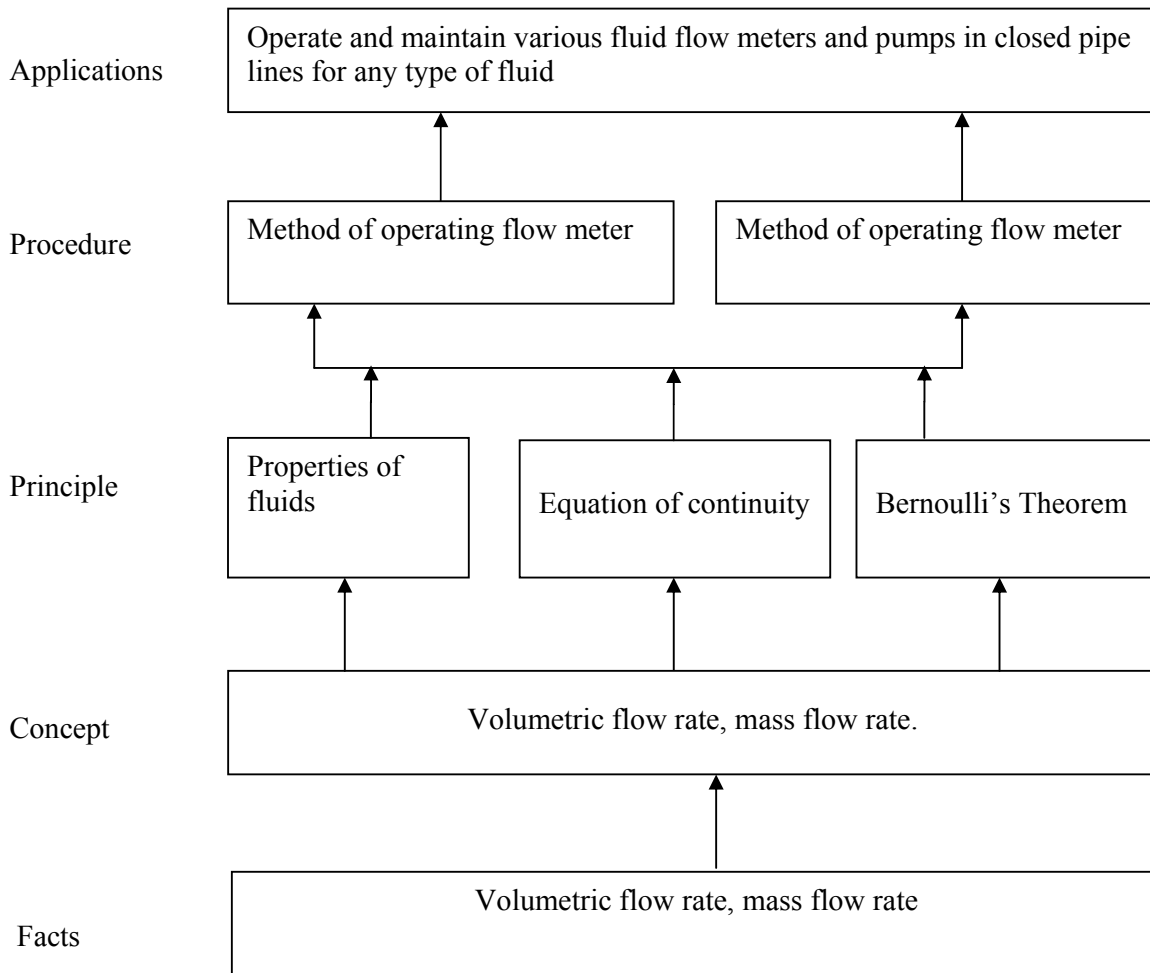
Rationale:

Knowledge of measurement of fluid flow and various fluid transportation machinery is useful to transport different process fluids. The knowledge of this subject helps in installation of different fluid transportation machinery. Principles of Fluid Flow operations are useful in understanding mass transfer and heat transfer operation.

General Objectives:**Students will be able to**

1. Understand the concept of viscosity.
2. Calculate mass and volumetric flow rates.
3. Understand the principles of different flow meters.
4. Install and calculate the flow rate of fluid with different flow meters in closed pipe line.
5. Understand working of different types of valves
6. Understand the principle and working of different fluid flow machinery.

Learning Structure:



Theory:

Chapter	Topics and Contents	Hours	Marks
1	<p>Introduction to Fluids :</p> <p>Specific Objective</p> <ul style="list-style-type: none"> • Calculate pressure using U tube manometer. • Compare Newtonian & Non Newtonian fluid. • State Newton's law of Viscosity. <p>1.1 Properties of fluids</p> <ul style="list-style-type: none"> • Density & viscosity (absolute & Kinematic) • Vapor pressure & partial pressure • Atmospheric pressure • Vacuum • Absolute pressure <p>1.2 Principle of Hydrostatic Equilibrium</p> <ul style="list-style-type: none"> • Pressure exerted by a liquid column • Various types of manometers such as U tube, Well type and inclined leg manometer • Pressure measurement by U-tube manometer and problem based on the same. <p>1.3 Types of fluids</p> <ul style="list-style-type: none"> • Ideal and actual fluids • Compressible and incompressible fluids • Newton's law of viscosity • Newtonian and Non-Newtonian fluids with example of each type. 	07	12
2	<p>Flow of Fluids (Incompressible & its measurement)</p> <p>Specific Objectives</p> <ul style="list-style-type: none"> • Calculate the volumetric flow rate using orifice meter and Venturi meter. • Calculate the frictional losses due to expansion and contraction. • State Hagen Poiseulli's equation. <p>2.1 Volumetric and Mass flow rate (16 marks)</p> <ul style="list-style-type: none"> • Concept of volumetric and mass flow rate • Interconversion of the above two • Average velocity • Mass velocity • Point velocity • Equation of continuity • Derivation of equation of continuity • Numericals based on above sub- topics <p>2.2 Reynolds Number</p> <ul style="list-style-type: none"> • Definition • Reynolds experiment • Concept of laminar, turbulent and transition flow • Critical velocity • Formula for Reynolds Number and Numericals. <p>2.3 Bernoulli's equation</p> <ul style="list-style-type: none"> • Various types of energies by liquid 	20	40

	<ul style="list-style-type: none"> • Derivation of Bernoulli's equation • Friction factor correction • Work done by pump • Kinetic Energy correction • Numerical <p>2.4 Friction (12 marks)</p> <ul style="list-style-type: none"> • Concept of friction in fluid flow • Types of friction- Form ,skin: Definition. • Relation between pressure drop, wall friction and shear stress • Shear stress distribution in pipes • Relation between average velocity and maximum velocity for laminar flow • Derivation of Hagen Poiseuille's equation • Problems on above topics <p>2.5 Friction in pipes</p> <ul style="list-style-type: none"> • Fanning's friction factor in Laminar and Turbulent flow • Friction factor chart • Friction losses due to sudden expansion and sudden contraction <p>2.6 Measurement of fluid flow (12 Marks)</p> <ul style="list-style-type: none"> • Variable head meter and variable area meter • Construction working principle, discharge coefficient, calibration, relative advantages and disadvantages, problems on- Orifice meter, Venturimeter • Rotameter construction, principle, concept of variation in flow area, calibration • Pitot tube, construction, advantages and formula to calculate point velocity 		
3	<p>Pipe, fittings & valves Specific Objectives</p> <ul style="list-style-type: none"> • List the different types of fittings & valves. • State equivalent length of pipe fitting, frictional losses in pipe fittings. <p>3.1 Pipe & Pipe Fittings</p> <ul style="list-style-type: none"> • Standard sizes of pipes, wall thickness, Schedule number & Material of construction • Various types of fittings • Equivalent length of pipe fittings <p>3.2 Classification of valves</p> <ul style="list-style-type: none"> • Construction, working, advantages of Globe, Gate, Plug, Ball ,Diaphragm, Needle, Control valve, Non return valve, Safety valve <p>3.3 Construction, working and application of Rupture disc.</p>	07	16
4	<p>Transportation of Fluids Specific Objectives</p> <ul style="list-style-type: none"> • Calculate the NPSH of the centrifugal pump. 	14	32

	<ul style="list-style-type: none"> • Compare centrifugal pump and positive displacement pump. • State the range of pressure developed by fan, blower and compressor. <p>4.1 Pumps (12 marks)</p> <ul style="list-style-type: none"> • Classification • Positive displacement pumps, their types, Reciprocating pump (single acting, double acting, duplex, triplex piston, plunger), gear pump, Diaphragm pump, Screw pump, Characteristics curves. <p>4.2 Centrifugal pump (10 Marks)</p> <ul style="list-style-type: none"> • Construction, various parts, development of pressure, air binding, priming, suction head, and discharge head, cavitation, NPSH etc. • Characteristics curve of Centrifugal pump <p>4.3 Fans, blowers & compressors: (10 marks)</p> <ul style="list-style-type: none"> • Specific applications of each equipment • Range of pressure developed by each type • Centrifugal blower • Reciprocating Compressor <p>Vacuum generating equipment Principle , construction and working of Vacuum pump, Jet ejectors</p>		
	Total	48	100

Practical:**Intellectual Skills**

1. Interpret data and result.
2. Calculate various parameters.
3. Identify errors and method of minimizing.

Motor Skills

1. Handle Equipment
2. Measure accurately various parameters.

Lists of Practicals:

1. Understand the phenomenon of viscosity, pressure gradient by demonstration.
2. Verify Reynolds experiment and calculate the Reynolds number at the end of laminar regime and beginning of turbulent regime.
3. Perform experiment based on Bernoulli's theorem and prove that the summation of pressure head, kinetic head and potential head is constant.
4. Estimate the fanning friction factor at different flow rate and draw friction factor chart.
5. Calculate the coefficient of discharge of a venturimeter and prepare calibration curve.
6. Calculate the coefficient of discharge of an orifice meter and prepare calibration curve.
7. Calibrate the rotameter and plot the calibration curve.
8. Determine head loss due to sudden expansion and contraction.
9. Calculate equivalent length of bend, globe valve and gate valve.
10. Plot and understand the characteristic curves of a centrifugal pump by using centrifugal pump test rig.

Assignments: Any Four

Sr. No.	Assignments
1	Calculate pressure at a specific point inside a liquid surface.
2	Conversion of pressure exerted in terms of various liquids columns.
3	Conversion of volumetric flow rate into mass flow rate. Calculating a average velocity, mass velocity.
4	5 Problems based on equation of continuity.
5	Problems based on Bernoulli's equation.
6	Problems based on Reynolds's number.
7	Problems based on calculating friction factor for Laminar and Turbulent flow.
8	Calculating pressure drop over certain length of pipe using above parameters.
9	Equivalent of different pipe fitting having these pipe fittings.
10	Calculating volumetric flow rate by Orificemeter, Venturimeter and Rotameter.
11	Calculating H.P. of pump for transporting liquid from one point to other point.

Learning Resources:**Book:**

Sr. No.	Author	Title	Publisher
1	McCabe, Smith	Unit Operations of Chemical Engineering	McGraw Hill
2	Badger & Banchero	Introduction to Chemical Engineering	McGraw Hill
3	Richardson & Coulson	Chemical Engineering Volume-I	Pergamon Press
4	P. Chattopadhyay	Unit Operations of Chemical Engineering	Khanna Publication

Websites: www.flowmaster.com
www.pipeflow.co.uk
www.radcoind.com
www.vlab.co.in

Course Name : Diploma in Chemical Engineering

Course Code : CH

Semester : Fourth

Subject Title : Chemical Process Technology-II

Subject Code : 17427

Teaching and Examination Scheme:

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

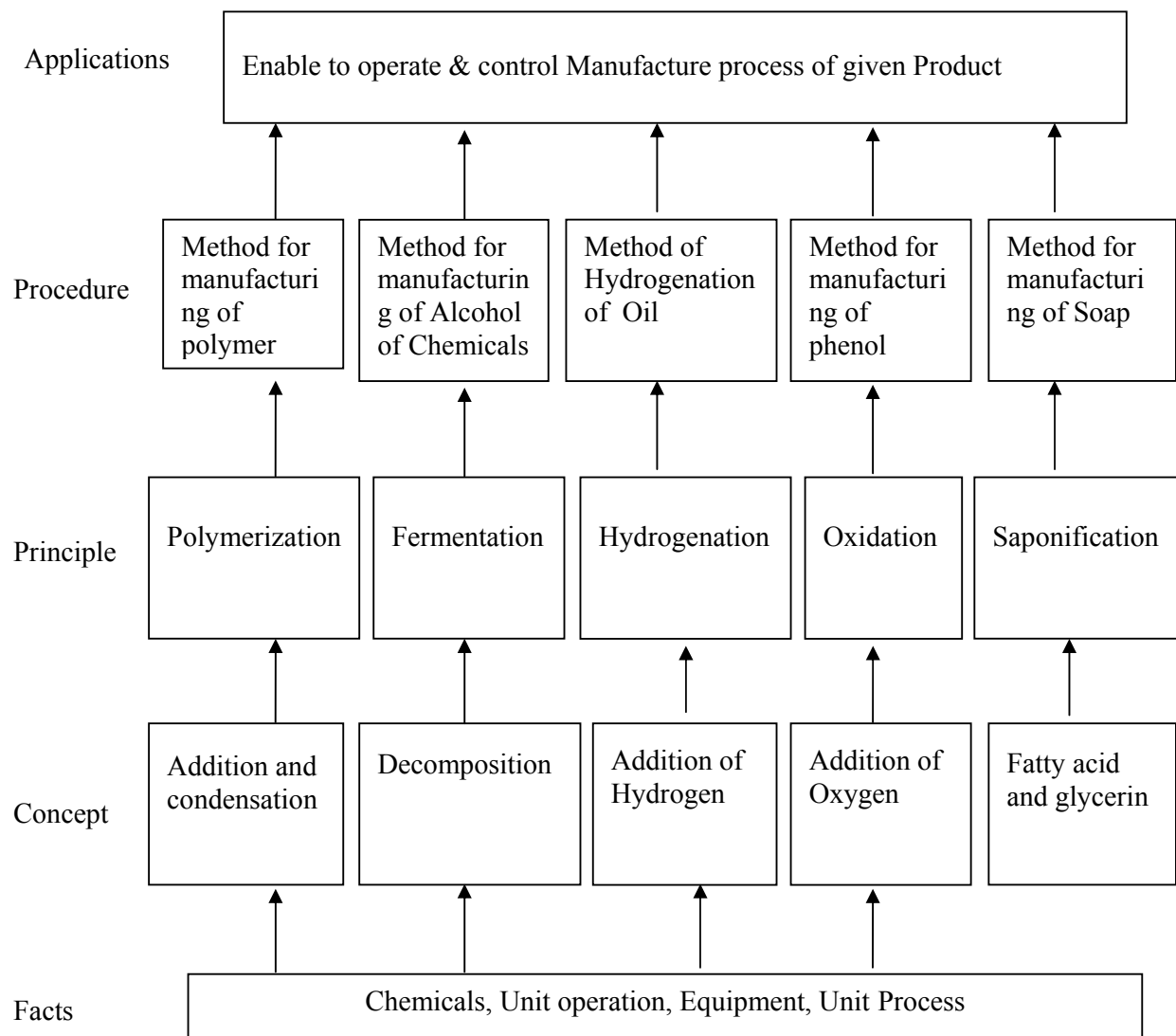
Rationale:

There are different type of Chemical industries like Small, Medium and Large Scale. Diploma students should able to operate and Control manufacturing process of various Chemicals. From this subject student will get knowledge of manufacture of chemicals like alcohol, phenol, oil, Soap, paper etc.

General Objectives:

The students will be able to

1. Know about Raw materials, Physical & Chemical Properties with Chemical reaction for the manufacture of various Chemicals.
2. Know manufacturing process of various chemicals
3. Understand uses of various Chemicals.

Learning structure:

Theory:

Chapter	Topic and Contents	Hours	Marks
1	<p>Alcohol</p> <p>Specific Objectives :</p> <ul style="list-style-type: none"> ➤ Describe manufacturing processes of alcohol with reaction ➤ Draw flow sheet/ block diagram <p>Content:</p> <p>Raw Materials , Reactions, Flow sheet/Block diagram, manufacturing process of products & their uses</p> <ul style="list-style-type: none"> • Ethyl alcohol by Corn & Molasses • Acetic Acid by Oxidation of Acetaldehyde • Butanol by Oxo process from Propylene 	06	16
2	<p>Paint</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State constituents of paint with function ➤ Describe manufacturing processes of paint ➤ State uses of Varnishes & Lacquers <p>Content:</p> <ul style="list-style-type: none"> • Properties of raw materials of paint & their functions • Manufacturing of paint • Constituent of Pigments <ul style="list-style-type: none"> - White pigment - Black pigment - Blue pigment - Red pigment • Varnishes - Oil & Spirit and their Uses • Lacquers - Definition & Uses 	05	12
3	<p>Oil, Soap & Detergent</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State Extraction process of oil ➤ State Hydrogenation of oil ➤ Describe manufacturing processes of soap & Detergent ➤ Explain cleansing action of soap <p>Content:</p> <p>3.1 Oil 08 Marks</p> <ul style="list-style-type: none"> • Definitions - Acid value , Iodine value, Saponification value of oil • Extraction of Oil by solvent process • Hydrogenation of Oil <p>3.2 Soap 06 Marks</p> <ul style="list-style-type: none"> • Classification of Cleansing Compounds • Manufacturing of Soap by <ul style="list-style-type: none"> - Batch Saponification Process - Continuous Hydrolysis & Saponification • Cleansing action of Soap 	08	20

	3.3 Detergents 06 Marks <ul style="list-style-type: none"> Manufacturing of detergents by <ul style="list-style-type: none"> Sulfated Fatty Alcohols Alkyl-Aryl Sulfonates 		
4	Pulp and Papers Specific Objectives: <ul style="list-style-type: none"> Describe manufacturing processes of Pulp & paper with reaction To draw flow sheet Content: <p>Raw Materials , Reactions, Flow sheet/Block diagram, manufacturing process of product & their uses</p> <ul style="list-style-type: none"> Pulp by Sulfate (Kraft) process & Sulphite process recovery of Chemicals Paper from pulp Rayon (viscous rayon) form cellulose 	05	12
5	Polymer Specific Objectives: <ul style="list-style-type: none"> State meaning of polymerization Describe manufacturing processes of polymer with reactions Content: <ul style="list-style-type: none"> Polymerization - Definition of (08 Marks) Polymerization, Methods of Polymerization – Addition & Condensation Raw Materials, Reactions, Flow sheet / Block diagram, manufacturing process of product & their uses (16 Marks) <ul style="list-style-type: none"> Poly Vinyl Chloride(PVC) by Emulsion polymerization Polyethylene by Ziegler process Low high medium pressure Polystyrene from Benzene & Ethylene Styrene Polyester Polyester by polymerization of DMT PTA & ethylene glycol 	15	24
6	Phenol Specific Objectives: <ul style="list-style-type: none"> Describe manufacturing processes of Phenol with reaction To draw flow sheet Content: <p>Raw Materials, Reactions, Flow sheet/Block diagram, manufacturing process of phenol & their uses</p> <ol style="list-style-type: none"> Cumene Peroxidation Process Toluene Oxidation Process Rasching Process Chlorobenzene-Caustic hydrolysis 	09	16
Total		48	100

Practical's:

Skills to be developed:

Intellectual Skills:

- Select suitable process of manufacturing
- Select proper process condition for getting maximum yield

Motor Skills:

- Work on manufacturing plant
- Set proper temperature and pressure condition
- Set controlling steps in manufacturing process

List of Practical's:

- Estimate the strength of glacial acetic acid by conductometric titration.
- Determine Iodine value of given oil sample by titration method.
- Determine the saponification value of given lubricating oil sample by KOH titration.
- Determine the acid value of given lubricating oil sample by KOH titration.
- Calculate the hiding power of given sample of paint.
- Calculate the percentage of thinner in a given sample of oil paint.
- Prepare phenol formaldehyde resin on the laboratory scale by using phenol and formaldehyde raw material.
- Prepare the soap by batch saponification process and analyze the moisture content of laboratory made soap.
- Prepare ethyl acetate from ethyl alcohol and acetic acid by esterification and determine its density and boiling point.

Mini Project (any Three):

- Compare moisture content of any three branded Washing Soap in Market (with respect to composition of each soap). Compare with TFM.
- Compare Hiding power of any three branded Paints in Market, Viscosity, %Thinner.
- Compare any three refined Oil available in market (with respect to acid value, saponification value)
- Collect information about different types of papers & compare their parameters w.r.t. GSM, folding strength.

Learning Resources:**Books:**

Sr. No.	Name of Book	Name of Author	Name of Publisher
1	Dryden Outline of Chemical Technology	M. Gopala Rao	East West Publishers 1997, New Delhi.
2	Shreve Chemical Process Industries	George Austin	Mc Graw Hill Publication 1984, Auckland
3	Chemical Process Organic Synthesis	P. H. Groggins	Mc Graw Hill 1958, Auckland.
4	Handbook of Industrial Chemistry VOL. II	Davis. K. H	C.B.S Publication 2004, New Delhi

Course Name : Diploma in Chemical Engineering

Course Code : CH

Semester : Fourth

Subject Title : CAD Software

Subject Code : 17039

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	02	--	--	--	--	25#	25

Rationale:

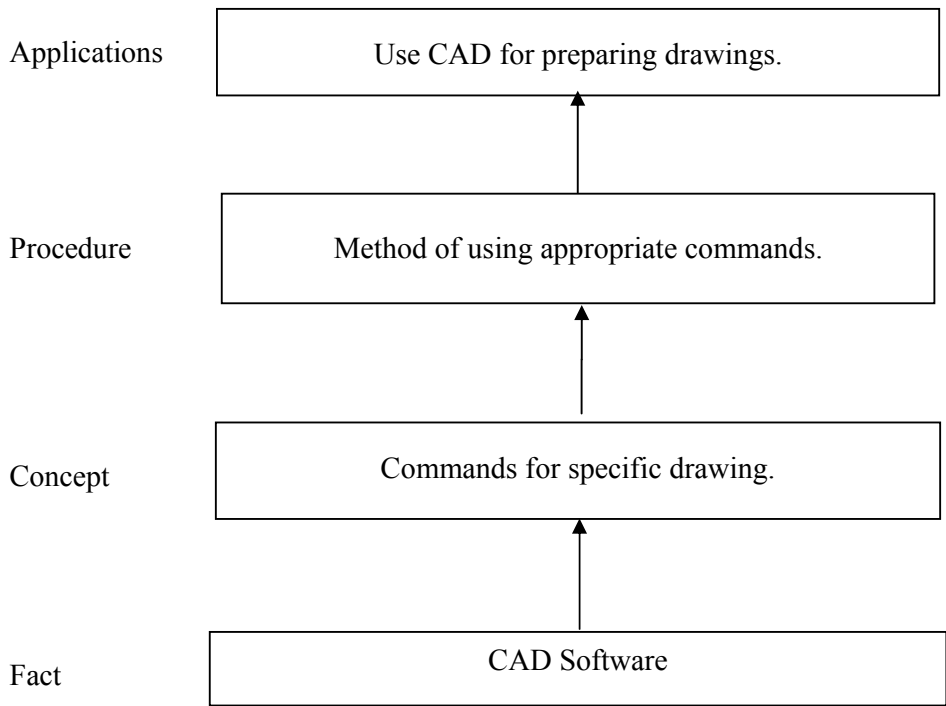
Drawing is the language of engineers. It conveys the meaning for construction and erection of Chemical Plant. Now a days computer has become an effective tool for preparing drawing through the software CAD. This subject provides sufficient practice to make use of CAD and draw required drawings.

General Objective:

After studying the subject students will be able to

- Draw process equipments.
- Draw and modify various objects
- Draw plant layout

Learning Structure:



List of Practical

Sr. No.	Name of Topic	Hours
1	Practice of basic commands such as draw, modify etc. (Related commands should be covered in practical period)	04
2	Draw symbols as per IS 3232	04
3	Draw flow diagram for given chemical process (any four)	12
4	Redraw the given Plant , Equipment layout and Utilities line diagram	12

Note:

1. Give different process for drawing of flow sheet.
2. For practical number 4, teacher has to provide drawing.
3. Printout of each CAD sheet will be part of Teamwork.

Learning Resources:

Sr. No.	Author	Title	Publisher
01	K Venugopal	Engineering Drawing and Graphics Auto CAD	New Age Publication
02	M.V. Joshi V.V Mahajan	Process Equipment Design	1997 Mac Milan India Ltd.
03	M Gopala Rao	Dryden Outline of Chemical Technology	East West Publishers 1997, New Delhi.
04	Indian standard	IS 3232	Govt. of India

Course Name : Diploma in Chemical Engineering**Course Code : CH****Semester : Fourth****Subject Title : Professional Practices-II****Subject Code : 17040****Teaching and Examination Scheme:**

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

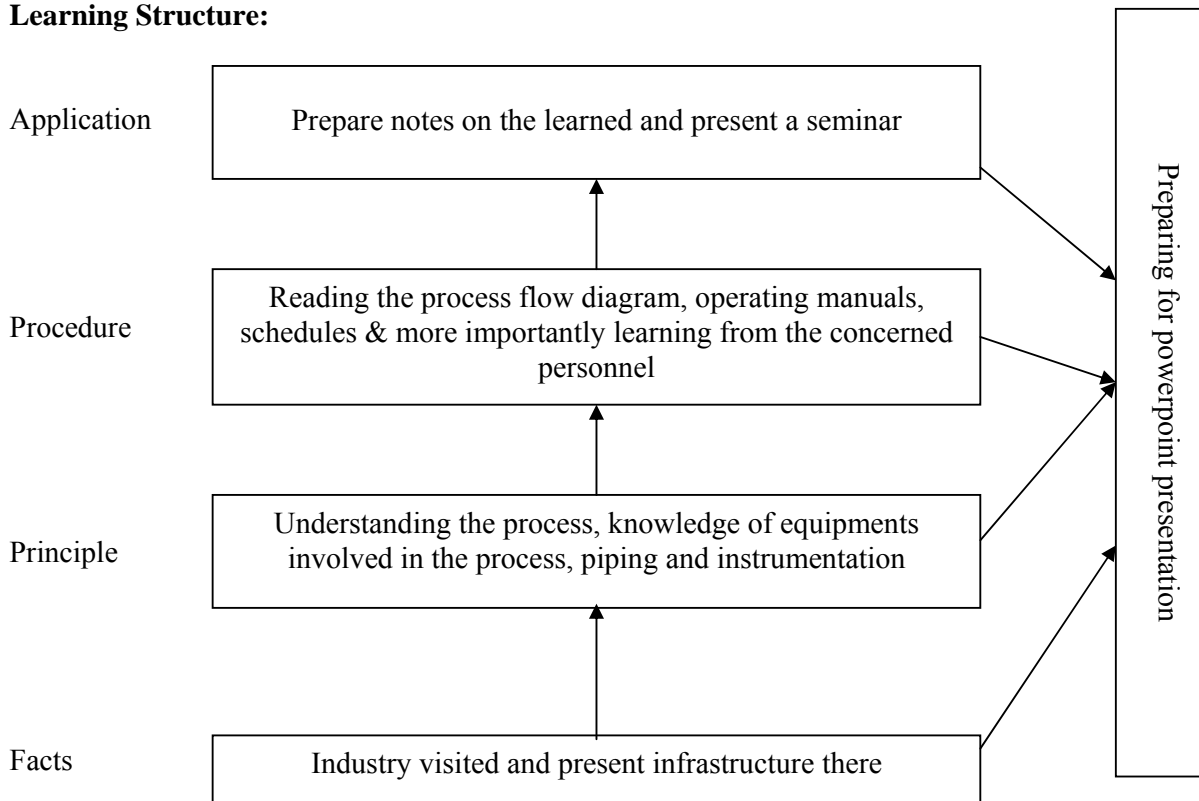
Rationale:

Engineering diploma holders are basically intended to work in industries. Their placements and selection for the jobs is based on the campus interview conducted by respective companies. Since the candidate is supposed to work and carry out actual engineering practices in the industries, his confidence, attitude and ability to communicate with the subordinates is usually tested apart from his technical subject knowledge.

To facilitate this and boost his capabilities the subject of professional practices aims to provide ample opportunities to the students. To accomplish this, industrial visits, lectures by professionals/experts, seminars and group discussions are planned during the semester.

Objectives:

1. To acquire information and data of different industry
2. To deliver the information and the knowledge required to develop awareness about latest trends in chemical industry.
3. To interact with fellow people and present their views.
4. To prepare report on industrial visit and 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.

Activities:

Contents	Hours
<p>1. Industrial Visits Industrial visits to be arranged and report of the same to be submitted by individual students to form the part of the term work. The report to contain information in respect to</p> <ol style="list-style-type: none"> Raw material required Finished product to be produced Capacity of the plant Utilities required and their consumption Man power requirement General costing Various equipments, unit operations and unit processes involved Storage and handling of material General layout of the plant <p>Visits to any two of the following.</p> <ol style="list-style-type: none"> Visit to ethanol plant Visit to rubber tyre retreading unit Visit to electroplating industry Visit to a fertilizer industry Visit to a plastic industry 	12
<p>2. Lectures Lectures by professionals / industrial experts / academicians Two sessions to be held on the following topics</p> <ol style="list-style-type: none"> Industrial filtration Mixing and agitation Fluid transportation and handling Cooling and refrigeration Steam generation Introduction to Apprenticeship Training Scheme 	06
<p>3. Seminars Seminar based on information search to be organized from any three of the following areas</p> <ol style="list-style-type: none"> Protection of environment Safety practices in chemical industries General maintenance in chemical plant Water purification Non conventional energy sources 	10
<p>4. Group Discussion The student should discuss in a group of 6 – 8 and write a brief report on the same. Group discussion to be monitored by faculty members. The following topics to be discussed</p> <ol style="list-style-type: none"> Selection of pumping devices Treatment of boiler feed water Selection of filtration equipments Fine chemicals and their applications 	12
<p>5. Student Activities The group of 3 – 4 students will perform any one of the following activities</p> <ol style="list-style-type: none"> Comparative statement of prices and specifications Information regarding specifications of different pumps and motors Create data base of past students 	08

d. Collect information regarding material of construction for pipe fittings, pumps and its components	
e. Collect information regarding various chemical industries in the vicinity of the institute.	
f. Collect information regarding specifications of common engineering materials	
Total	48

Learning Resources:**1. Books:**

Sr. No.	Title
1.	Fourth semester subjects reference books
2.	Journals and magazines - IEEE Journals, IT technologies.
3.	Local news papers and events
4.	Apprenticeship Training Scheme:- Compiled By – BOAT (Western Region), Mumbai, Available on MSBTE Web Site.

2. Websites:

1. <http://www.wikipedia.com>
2. <http://www.seminarforyou.com>

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/DC/TC/TX/FG**

Industrial Training (Optional) after 4th semester examination.

Note:- Examination in Professional Practices of 5th Semester.

INDUSTRIAL TRAINING (OPTIONAL)

Rational:-

There was a common suggestion from the industry as well as other stakeholders that curriculum of Engineering and Technology courses should have Industrial training as part of the curriculum. When this issue of industrial training was discussed it was found that it will be difficult to make industrial training compulsory for all students of all courses as it will be difficult to find placement for all the students. It is therefore now proposed that this training can be included in the curriculum as optional training for student who is willing to undertake such training on their own. The institutes will help them in getting placement or also providing them requisite documents which the student may need to get the placement.

Details:- Student can undergo training in related industries as guided by subject teachers / HOD.

- The training will be for four weeks duration in the summer vacation after the fourth semester examination is over.
- The student undergoing such training will have to submit a report of the training duly certified by the competent authority from the industry clearly indicating the achievements of the student during training. This submission is to be made after joining the institute for Fifth semester.
- The student completing this training will have to deliver a seminar on the training activities based on the report in the subject Professional Practices at Fifth Semester.
- The student undergoing this training will be exempted from attending activities under Professional Practices at Fifth semester except the seminar.
- The students who will not undergo such training will have to attend Professional Practices Classes/activities of fifth semester and will have to complete the tasks given during the semester under this head.
- There work will be evaluated on their submissions as per requirement and will be given marks out of 50. Or student may have to give seminar on training in Industry he attended.
- Institute shall encourage and guide students for Industry training.
- Evaluation:- Report of Training attended and delivery of seminar and actual experience in Industry will be evaluated in fifth semester under Profession Practices-III and marks will be given accordingly out of 50.