

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING
COURSE CODE : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/EE/EP/CH/CT/PS/CD/EDEI/CV/FE/IU/MH/MI
SEMESTER : SIXTH FOR EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/EE/EP/CH/CT/PS/CD/ED/EI/CV AND SEVENTH FOR MH/MI/FE/IU
SUBJECT TITLE : MANAGEMENT
SUBJECT CODE : 9133

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HR.	TH	TEST	PR	OR	TW	TOTAL
03	--	--	03	80	20	--	--	--	100

Rationale:

After completion of three years of technical training, Polytechnic students are expected to enter in to the World of Work. The business environment is altogether different and new to the students. A proper introduction and understanding of Business Processes is therefore essential for all Polytechnic students. Management is a subject which deals with basics of Managerial science required to understand the processes in Industrial & Commercial environment. This will enable the students of Polytechnics to become familiar and to understand various Business Organizational structures, their functioning and the Role these technicians will have to play in these setups with responsibilities.

Objective:

The students will able to:

1. Familiarize environment in the world of work
2. Explain the importance of management process in Business.
3. Identify various components of management.
4. Describe Role & Responsibilities of a Technician in an Organizational Structure.
5. Apply various rules and regulations concerned with Business & Social Responsibilities of the Technician.

Contents: Theory

Chapter No.	Name of the Topics	Hours	Marks
01	Overview Of Business 1.1. Types of Business <ul style="list-style-type: none">• Service• Manufacturing• Trade 1.2. Industrial sectors Introduction to <ul style="list-style-type: none">• Engineering industry• Process industry• Textile industry• Chemical industry• Agro industry 1.3 Globalization <ul style="list-style-type: none">• Introduction• Advantages & disadvantages w.r.t. India 1.4 Intellectual Property Rights (I.P.R.)	02	---
02	Management Process 2.1 What is Management? <ul style="list-style-type: none">• Evolution• Various definitions• Concept of management• Levels of management• Administration & management• Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management <ul style="list-style-type: none">• Planning• Organizing• Directing• Controlling	07	12
03	Organizational Management 3.1 Organization :- <ul style="list-style-type: none">• Definition• Steps in organization 3.2 Types of organization <ul style="list-style-type: none">• Line• Line & staff• Functional• Project 3.3 Departmentation <ul style="list-style-type: none">• Centralized & Decentralized• Authority & Responsibility• Span of Control 3.4 Forms of ownership <ul style="list-style-type: none">• Proprietorship• Partnership• Joint stock• Co-operative Society• Govt. Sector	07	12

04	<p>Human Resource Management</p> <p>4.1 Personnel Management</p> <ul style="list-style-type: none"> • Introduction • Definition • Functions <p>4.2 Staffing</p> <ul style="list-style-type: none"> • Introduction to HR Planning • Recruitment Procedure <p>4.3 Personnel– Training & Development</p> <ul style="list-style-type: none"> • Types of training ➤ Induction ➤ Skill Enhancement <p>4.4 Leadership & Motivation</p> <ul style="list-style-type: none"> • Maslow’s Theory of Motivation <p>4.5 Safety Management</p> <ul style="list-style-type: none"> • Causes of accident • Safety precautions <p>4.6 Introduction to –</p> <ul style="list-style-type: none"> • Factory Act • ESI Act • Workmen Compensation Act • Industrial Dispute Act 	08	16
05	<p>Financial Management</p> <p>5.1. Financial Management- Objectives & Functions</p> <p>5.2. Capital Generation & Management</p> <ul style="list-style-type: none"> • Types of Capitals • Sources of raising Capital <p>5.3. Budgets and accounts</p> <ul style="list-style-type: none"> • Types of Budgets ➤ Production Budget (including Variance Report) ➤ Labour Budget • Introduction to Profit & Loss Account (only concepts) ; Balance Sheet <p>5.4 Introduction to –</p> <ul style="list-style-type: none"> • Excise Tax • Service Tax • Income Tax • VAT • Custom Duty 	08	16
06	<p>Materials Management</p> <p>6.1. Inventory Management (No Numericals)</p> <ul style="list-style-type: none"> • Meaning & Objectives <p>6.2 ABC Analysis</p> <p>6.3 Economic Order Quantity</p> <ul style="list-style-type: none"> • Introduction & Graphical Representation <p>6.4 Purchase Procedure</p> <ul style="list-style-type: none"> • Objects of Purchasing • Functions of Purchase Dept. • Steps in Purchasing <p>6.5 Modern Techniques of Material Management</p> <ul style="list-style-type: none"> • Introductory treatment to JIT / SAP / ERP 	08	16

07	Project Management (No Numericals)	08	08
	7.1 Project Management <ul style="list-style-type: none"> • Introduction & Meaning • Introduction to CPM & PERT Technique • Concept of Break Even Analysis 7.2 Quality Management <ul style="list-style-type: none"> • Definition of Quality , concept of Quality , Quality Circle, Quality Assurance • Introduction to TQM, Kaizen, 5 ‘S’, & 6 Sigma 		
TOTAL		48	80

Learning Resources:

Books:

Sr. No	Author	Name of Book	Publisher
01	Dr. O.P. Khanna	Industrial Engg & Management	Dhanpal Rai & sons New Delhi
02	Dr. S.C. Saksena	Business Administration & Management	Sahitya Bhavan Agra
03	W.H. Newman E.Kirby Warren Andrew R. McGill	The process of Management	Prentice- Hall
04	Rustom S. Davar	Industrial Management	Khanna Publication
05	Banga & Sharma	Industrial Organisation & Management	Khanna Publication
06	Jhamb & Bokil	Industrial Management	Everest Publication , Pune

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING

COURSE CODE : CH

SEMESTER : SIXTH

SUBJECT TITLE : MASS TRANSFER OPERATION

SUBJECT CODE : 9210

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
03	--	04	03	80	20	50#	--	25@	175

Rationale:

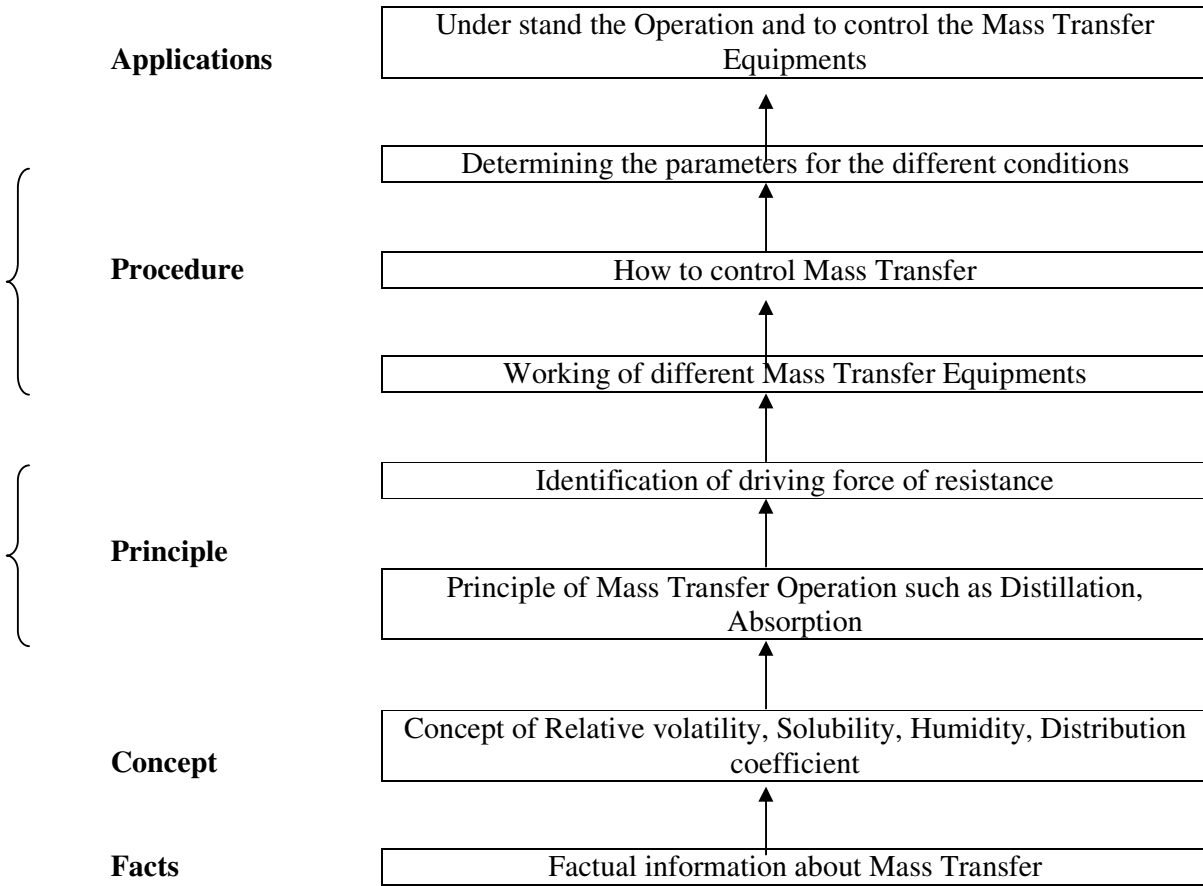
This subject intends to equip the students with the concept and principles of mass transfer operation, which are of prime importance in any chemical industry. Mass transfer equipments are an integral part of any chemical plant. This subject will help the students to operate and design various mass transfer equipments.

Objectives:

After studying the subject student will be able.

1. To identify principles of diffusion.
2. To analyze distillation column and to solve problems on distillation.
3. To do material balance for gas absorption columns.
4. To identify various extraction equipments and to compare extraction and distillation,
5. To solve the problems on Drying & to operate various drying equipments.
6. To operate various crystallization equipments.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1	<p>Diffusion.</p> <p>1.1 Definition, Ficks Law, Flux equation, Molecular diffusion in gases, Steady state diffusion of A through non diffusing B, Steady state equimolar counter diffusion. Problems.</p> <p>1.2 Analogy between mass transfer and heat transfer, film theory, surface renewal theory, penetration theory, equilibrium.</p>	05	08
2	<p>Distillation.</p> <p>2.1 Concept of distillation, Gibbs phase rule, concept of degree of freedom, boiling point diagram, change of pressure on boiling point diagram.</p> <p>2.2 Vapour liquid equilibrium diagram. Henry's Law, Raoult's Law. Determination of vapor composition by above laws.</p> <p>2.3 Volatility, Relative volatility, Derivation to calculate vapour composition and liquid composition Problems.</p> <p>2.4 Methods of distillation, Differential distillation, Rayleigh's equation, problems, Flash distillation, material balance, Problems .</p> <p>2.5 Rectification, Fractionating column, material balance, Mc Cabe Theile method. Lewis Sorrel method, problems.</p> <p>2.6 Feed plate, feed line, q line, effect of feed conditions on slope of q line.</p> <p>2.7 Reflux ratio, total reflux ratio, minimum reflux ratio, relative advantages and dis-advantages on operating and capital cost. Optimum reflux ratio.</p> <p>2.8 Batch distillation, Azeotropic distillation, steam distillation- Equipment for distillation, plate column, Bubble cap plate, sieve plate, and valve plate, down comers, weir, packed columns.</p>	16	24
3	<p>Absorption.</p> <p>3.1 Concept of Gas Absorption, comparison with distillation, selection criteria for solvent.</p> <p>3.2 Concept of equilibrium, minimum liquid-gas ratio, material balance Concept of HETP.</p> <p>3.3 Hydrodynamics of packed column. Loading and flooding of packed columns.</p> <p>3.4 Gas absorption equipments- mechanically agitated vessel, packed columns, types of packing, channeling in packed columns.</p>	06	10
4	<p>Extraction.</p> <p>4.1 Concept of Extraction liquid-liquid extraction comparison between distillation and extraction, distribution coefficient, triangular diagram.</p> <p>4.2 Extraction equipments mixer settler, spray column, rotating disc contactor, pulse column.</p>	06	10
5	<p>Drying.</p> <p>5.1 Concepts & general principles, equilibrium Rate of drying curve, time of drying, Problems based on above topic.</p> <p>5.2 Drying equipments- Tray drier, Rotary drier, Drum drier, Spray drier, fluidized bed drier, Pneumatic drier, applications.</p>	08	16

6	Crystallization.	07	12
	6.1 Concept of crystallization, saturation, super saturation, solubility curves		
	6.2 Method of super saturation, Mier's super saturation theory. 6.3 Crystallization equipments- Agitated tank crystalliser, vacuum crystalliser, Oslo (cooler and evaporative) crystalliser.		
TOTAL		48	80

Practical:

Intellectual Skills:

1. To compare different types of distillation.
2. To design a fractionating column.
3. To select suitable solvent for extraction.
4. To compare the effect of dry and wet packing on pressure drop.

Motor Skills:

1. To operate different distillation columns.
2. To operate different types of dryers.
3. To control operating parameters of distillation column.

List of Practicals:

1. To verify Rayleigh's equation by simple distillation.
2. To calculate HETP by carrying out distillations in a packed column at total reflux.
3. To calculate the pressure drop of a given packed column for wet and dry packing.
4. To find out distribution coefficient for liquid - liquid mixture.
5. To plot binodal curve for ternary system.
6. To plot drying rate curves.
7. To plot the solubility curve while heating and cooling.
8. Control of distillation column on simulator.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
1.	Mr. Walter L. Badger & Mr. Julius T. Bachero	Introduction to Chemical Engineering	Mc Graw Hill International
2.	Mc Cabe, W. L. Smith & Harriot.	Unit Operations of Chemical Engineering.	Mc Graw Hill International
3.	Treybal	Mass Transfer Operations	Mc Graw Hill International

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING

COURSE CODE : CH

SEMESTER : SIXTH

SUBJECT NAME : CHEMICAL ENGINEERING DRAWING

SUBJECT CODE : 9211

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
02	--	04	--	--	--	--	50#	50@	100

Rationale:

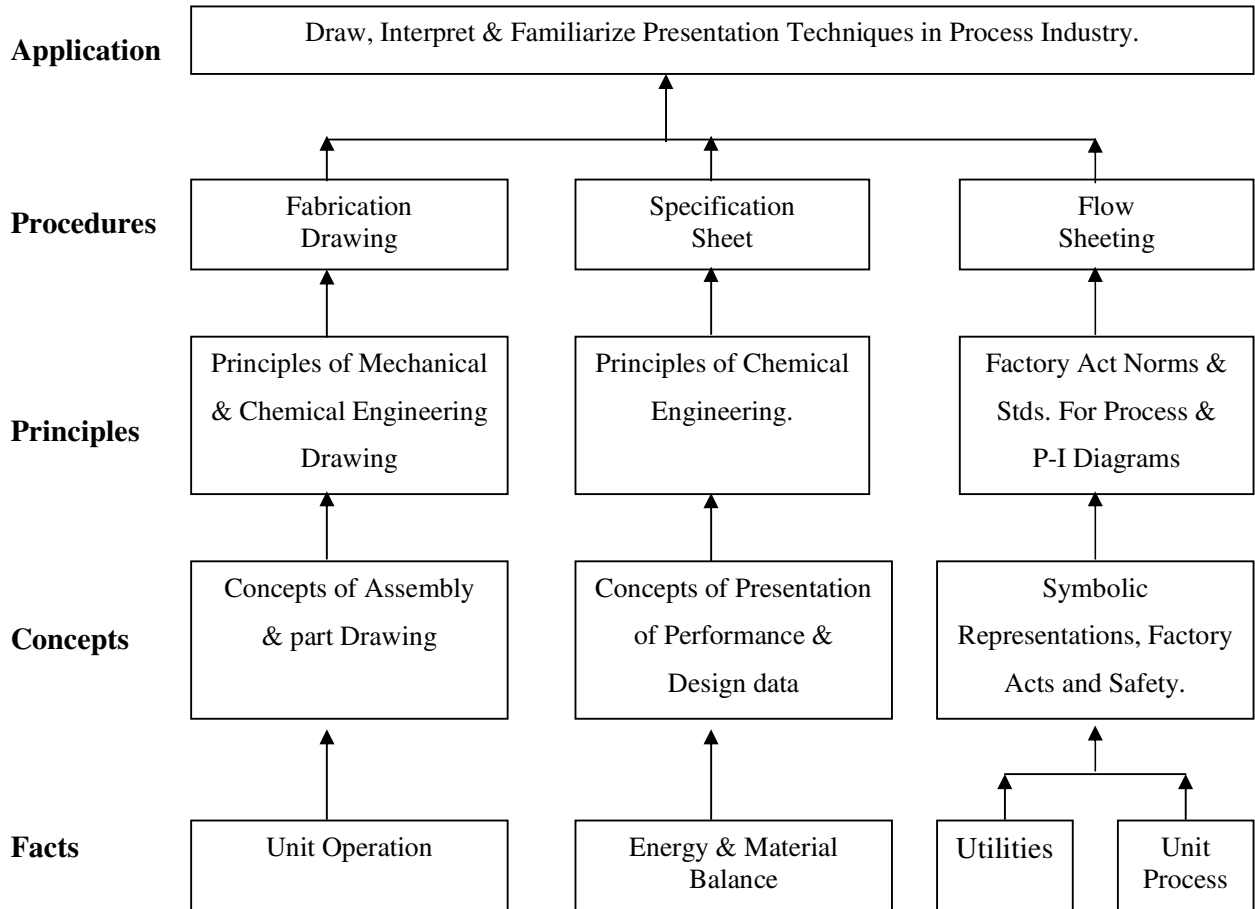
This subject is related to different types of symbols & Chemical process drawing with respective to equipments which are used in Chemical Industry. In addition, this subject covers details and assembly drawing of major plant equipment.

Objectives:

The student will be able

1. To draw and explain the symbol as per IS code.
2. Prepare PFD, ULD & PI Diagram as per the process.
3. Prepare specification for different Chemical Equipments.
4. Prepare equipment layout & Tank farm Drawing.
5. Prepare PFD on CAD.

Learning Structure



Contents: Theory

Chapter	Name of the Topic	Hours
1	Process Instrumentation Symbols.	01
2	Valves: Sectional views of: Gate valve, Globe valve, Ball valve, Check valve, (Swing & lift check valve), Diaphragm valve, safety valve (Spring Loaded / Rams bottom).	05
3	Pipe Joints. 3.1 Threaded, flanged and other joints 3.2 Bend (Short & Long) 3.3 Elbow 3.4 Tee 3.5 Nipple 3.6 Socket, Reducing socket 3.7 Union Joint 3.8 Plug 3.9 Flanges. Blind, C.I., Slip on, welded Neck, Hub type, Hap type Screwed type. 3.10 Socket and spigot joint. 3.11 Hydraulic joint. 3.12 Expansion joints loop and Corrugated.	02
4	Supports for pipe and vessels. 4.1 Hanger 4.2 Roller 4.3 Yard piping support. 4.4 Vessel support. Vertical vessel, Leg, Skirt, Bracket, lug support. Horizontal vessel saddle type.	03
5	Fabrication Drawing. 5.1 Shell and tube heat exchanger. 5.2 Batch Reactor. 5.3 Horizontal storage tank. 5.4 Short tube Vertical Evaporator 5.5 Types of Packing. 5.6 Types of distributor: Weir type and spider type. 5.7 Liquid redistributor. 5.8 Grid bar support plate. 5.9 Types of Heads.	05
6	Specification Sheet. 6.1 Centrifugal Pump. 6.2 Reciprocating pump. 6.3 Batch reactor. 6.4 Shell and tube heat Exchanger.	04
7	7.1 Process flow sheeting (ULD & PFD) 7.2 Piping and Instrumentation Diagram of Chemical processes. 7.3 Equipment Layout 7.4 Tank Form	10
8	Revision of CAD & Process flow Diagram on CAD.	02
TOTAL		32

Practical:

- Notes :** 1) Students should be use A3 size sketch book for class work.
2) Use Approximately 570mm×380mm size drawing sheet for term work.

List of Practicals	Skill to be Developed	
	Intellectual Skills	Motor Skills
1) VALVES, Two sheet comparison of the above topic to be drawn	To develop ability to learn different type of valve	To developed the ability to drown the sectional view
2) Two sheet on all pipe joints	To developed ability to identify different types of pipe joint flanges.	To developed ability of different types of pipe joint
3) One sheet on support for pipe & vessels	To developed learn support for pipe & vessels	--
4) Two sheet on fabrication drawing	To developed ability to identify the different types of chemical equipment	To developed the ability draw the sectional view
5) One sheet on preparation of any one from the topic, chapter 06 specification	To drown prepare the details of the equipment	To learn details construction of the equipment.
6) Two sheet on topic 7.1 & 7.2 one sheet on topic 7.2 one sheet on topic (7.3 7.4 combined)	To developed ability between PFD, ULD & P & I diagram	--
7) One sheet on CAD w.r.t. to topic 7.1	To develop ability to learn CAD	To draw PFD on computer.

Learning Resources:**Books:**

Sr. No.	Name of Book	Name of Author	Name of Publisher
1.	Process Equipment Design	M.V. Joshi V.V. Mahajan	1997 Mac Milan India Ltd. New Delhi
2.	Process Design of Equipments	Dr. S.D. Dawande	1999 Central Techno publication Nagpur
3.	Chemical Process Equipment	Sranley M. Walas	1988 Butter worth Publishers Reed Publishing Inc (USA) Boston.
4.	A First Year Engineering Drawing	A.C. Parkinson	1995 A.H. Wheeler & Co. Allahabad
5.	Machine Drawing	N.D. Bhatt	1986 Charottar Publishing House Anand (Gujrat)

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING
COURSE CODE : CH
SEMESTER : SIXTH
SUBJECT NAME : ENVIRONMENTAL TECHNOLOGY
SUBJECT CODE : 9212

TEACHING AND EXAMINATION SCHEME:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS.	TH	TEST	TR	OR	TW	TOTAL
03	--	02	03	80	20	--	--	25@	125

Rationale:

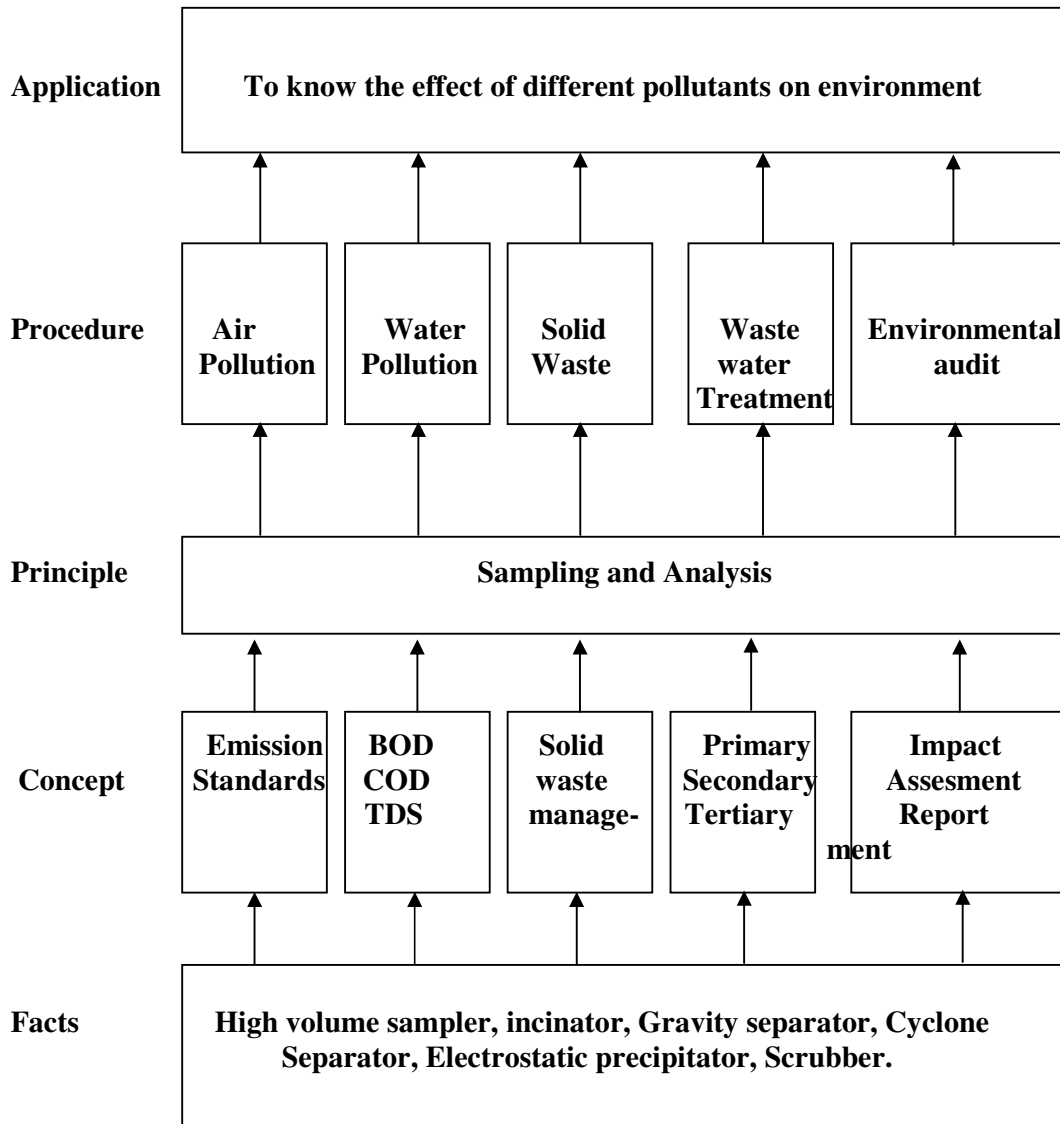
This subject is related with different pollution problems and their controlling methods related with air pollution, water pollution, automobile exhaust, waste water treatment, solid waste management as well as ISO 14001.

Objectives:

The subject student will be able

1. To understand the pollution problem.
2. To know the effects of different pollutants in the environment.
3. To learn different equipments used to control the pollution.
4. To understand basic design calculation.
5. To understand the norms of ISO 14001.

Learning structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1	Air Pollution 1.0 Introduction. 1.1 Air Pollutants. 1.2 Natural sources of air pollution. 1.3 Man made sources of air pollution. 1.4 Effect of air pollution on health, animals and material. 1.5 Principle of air sampling, particulate and gaseous sample collection methods. 1.6 Controlling methods. 1.6.1 Gravity Settling Chamber. 1.6.2 Cyclone separator. 1.6.3 Fabric Filter. 1.6.4 Wet Scrubber. 1.6.5 Electrostatic Precipitator. 1.6.6 Absorption, Adsorption and incineration.	12	20
2	Water Pollution. 2.1 Introduction. 2.2 Role of Pollution Control Board. 2.3 Different Sampling Methods. 2.4 Different Physical Treatment methods, 2.5 Different Chemical Treatment Methods. 2.6 Different Biological Treatment Methods.	10	16
3	Solid Waste Management. 3.1 Solid Waste Characteristics. 3.2 Solid Waste Collection. 3.3 Solid Waste Processing. 3.4 Reuse, Recycle and Recovery. 3.5 Disposal. (Biomedical)	08	14
4	Waste Water Treatment 4.1 Introduction. 4.2 Preliminary Treatment. 4.3 Primary Treatment 4.4 Secondary (Biological) Treatment. 4.4.1 Trickling Filters. 4.4.2 Activated Sludge Treatment. 4.5 Sludge Management. 4.6 Sludge Characteristics 4.7 Sludge Treatment. 4.7.1 Sludge Thickening. 4.7.2 Sludge Digestion. 4.7.3 Sludge Dewatering. 4.7.4 Sludge Disposal.	12	20
5	Environmental Audit & ISO – 14000 5.1 Need of Environmental Audit. 5.2 Procedure for Environmental Audit. 5.3 Advantages of Environmental Audit. 5.4 Need of ISO 14001. 5.5 Business benefits of ISO 14000.	06	10
TOTAL		48	80

Practical:

Skills to be Developed:

Intellectual skills:

- 1) To identify different pollution in atmosphere.
- 2) To decide pollution control methods.
- 3) To classify different solid waste.
- 4) To select proper method for disposal of solid waste.
- 5) To design simple parameter for waste water treatment.

Motor skills:

- 1) To work on effluent treatment plant.
- 2) To prepare audit report.
- 3) To set procedure for ISO-14000.
- 4) To handle different pollution controlling equipment.

List of Practicals:

- 1) To estimate the concentration of H_2S and CS_2 in work room by modified gas analyser.
- 2) Determination of COD of the given effluent sample.
- 3) To measure the suspended particles in liquid by turbidity?
- 4) To estimate chloride content of given water sample.
- 5) To determine BOD of given sample.
- 6) Determination of acidity / alkalinity in given effluent sample.
- 7) Determination of total solids , total suspended solids , total dissolved solids in given effluent sample.
- 8) Prepare an environment audit report for any process industry.
- 9) Estimation of suspended particulate in matter , in air by high volume sampler.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publishers
1.	Dr. P. K. Khatolitya	Environmental Pollution.- 2004	C. Chand & Company Ltd. New Delhi- 55.
2.	Mr. P. A.Vesilind	Introduction to Environmental Engineering.- 1997	PWS Publishing Company, Boston.
3.	Jerry Natheson	Basic environmental Technology.- 2002	New Delhi Prentice- Hall of India Pvt. Ltd.
4.	G. N. Pandey & G. C. Carney	Environmental Engineering- 1989	Tata Mc GrawHill, New Delhi.
5.	Dr. H. S. Bhatia	Text Book of Environmental Pollution and Control.- 1998	New Delhi Galgotia Publication.
6.	Mr. S. S. Dara.	A Text Book of Environmental Chemistry and Pollution Control.- 1991	S. Chand & Company Ltd. New Delhi.
7.	S. S. Rao	Environmental Pollution control	Wiky Eastern Ltd. New Delhi
8.	Mr. D. K. Asthana & Mrs. Meera Asthana.	Environmental Problem and Solution.- 2001	S. Chand & Company Ltd. New Delhi.
9.	Mr. S. P. Mahajan.	Pollution Control in Process Industries.- 1985	Tata Mc GrawHill, New Delhi.

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING
COURSE CODE : CH
SEMESTER : SIXTH
SUBJECT NAME : PROCESS SIMULATION
SUBJECT CODE : --

TEACHING AND EXAMINATION SCHEME:

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

Rationale:

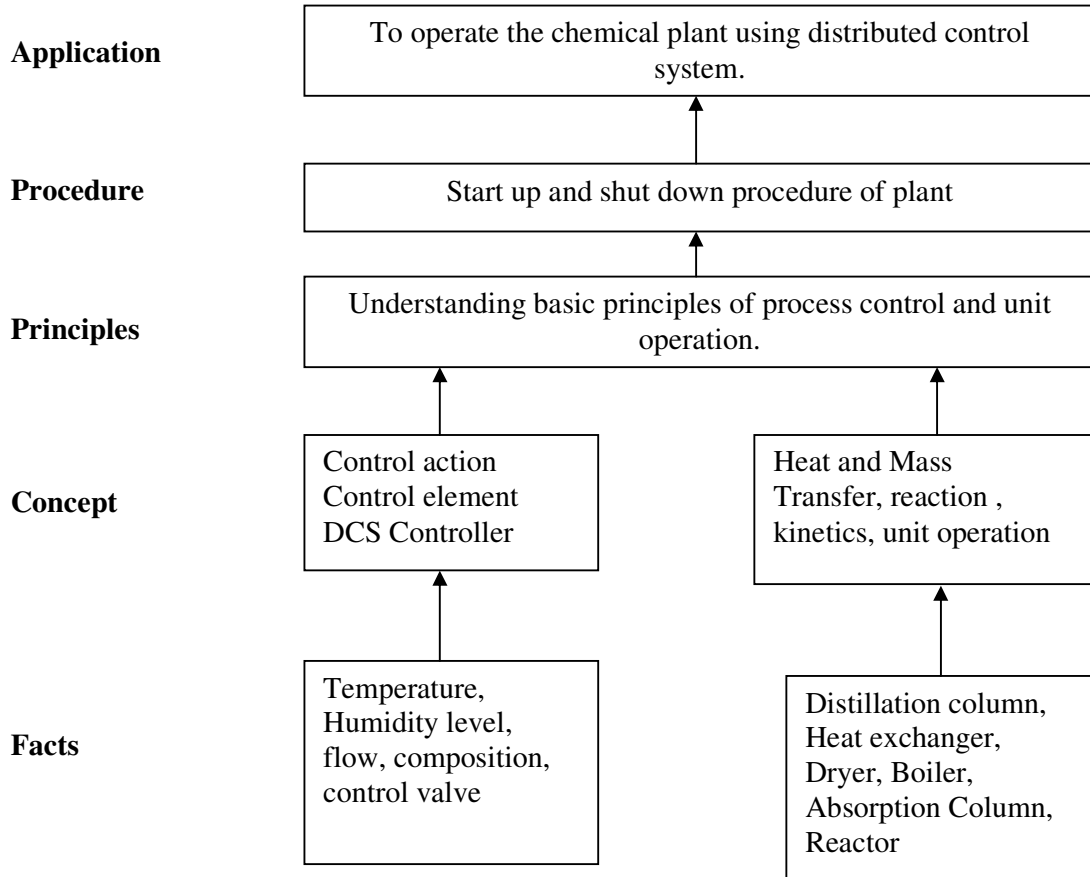
Most of the chemical process plant are operated and Controlled through Distributed Control System (DCS). It is necessary to train student on DCS process simulator where he will get first hand experience of process plant Operation and control.

Objectives:

Student will be able to:

- 1) Understand process instrument controls.
- 2) Get familiarized with the various chemical process.
- 3) Get experience and exposure to set of typical upset And equipment malfunction.
- 4) Learn and practice correct startup and shutdown Procedure.
- 5) Practice event which occurs occasionally such as Emergency condition and upsets.

Learning Structure:-



Content:- Theory

Note- content of theory are to be taught in practical period.

Chapter	Name of Topic
1	Process Simulators Need of simulators, Application simulators distributed controlled system-Dynamic Graphic (mimic), Bar graph, Trend and Alarm.
2	Process Simulator Software Installation of software. Introduction of software feature using member, Toolbar, dilogbar, Toolbar, Status bar Scroll bar Title bar. Screens (Display), Mimics, bar graph, trend alarms, snapshots, back track, caution longing, connectivity between bar graph – mimics-trends-alarm exercise-loading, saving, delete, controlling the session – run freeze, quit etc. mal function, online help, star up and shut down procedure.

Practical:

Note :- Print of logs to be attached as term work.

- 1) Practice correct startup and shutdown procedure of the plant.
- 2) Change the P, I, D values and process parameters and observe then change in trend, bar graphs and mimics.
- 3) The should attend the malfunction occurring in the plant then restoring to its design conditions.
- 4) The should practice the above exercise on any six process modules given below using process simulators.
 - i) Binary distillation column for Benzene and Toluene.
 - ii) Temperature and pressure control
 - iii) Stirred tank reactor.
 - iv) Filtration.
 - v) Level and Flow in different type size vessels.
 - vi) Three-element boiler control.
 - vii) Level control in coupled tanks.
 - viii) Pressure control in different sizes valve.
 - ix) Catalytic reactor.
 - x) Absorption
 - xi) Superheated steam
 - xii) Dryer
 - xiii) Heat Exchanger
 - xiv) Multi component distillation column

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING

COURSE CODE : CH

SEMESTER : SIXTH

SUBJECT TITLE : PROFESSIONAL PRACTICES VI

SUBJECT CODE : --

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
--	--	05	--	--	--	--	--	50@	50

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts.

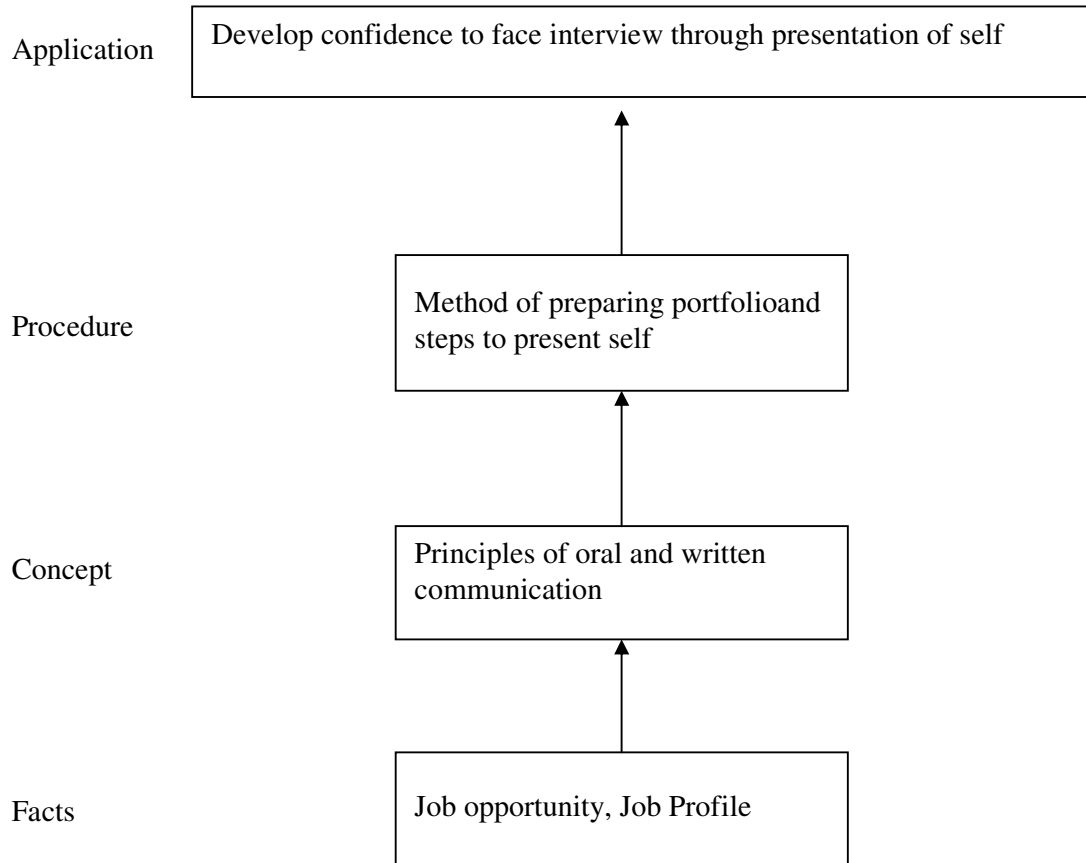
The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objectives:

Student will be able to:

1. Acquire information from different sources.
2. Prepare notes for given topic.
3. Present given topic in a seminar.
4. Interact with peers to share thoughts.
5. Prepare a report on industrial visit, expert lecture.

Learning Structure:



Sr. No.	Activities	Hours
01	<p>Industrial Visits: Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to any two of the following :</p> <ul style="list-style-type: none"> i) To see working of a Distillation Column. ii) E. T. P. of a chemical industry. iii) To visit a sugar industry. iv) To visit a food or pharmaceutical industries. v) H. R. department of a chemical industry. 	08
02	<p>Lectures by Professional / Industrial Expert / Student Seminars based on information search to be organized from any of the following areas:</p> <ul style="list-style-type: none"> i) Energy auditor. ii) Management. iii) Enterpriser. iv) Recent trands in Distillation. v) Pollution control board offical. 	08
03	<p>Group Discussion : The students should discuss in a group of six to eight students and write a brief report on the same as a part of term work. Two topics for group discussions may be selected by the faculty members. Some of the suggested topics are -</p> <ul style="list-style-type: none"> i) Steam distillation. ii) Azeotropic Distillation. iii) Interview techniques. iv) Non-convential and energy sources. 	08
04	<p>Student Activities : The students in a group of 3 to 4 will perform any one of the following activities (others similar activities may be considered. Activity :</p> <ul style="list-style-type: none"> i) Collect five different types of crystalline chemical with their purification. ii) Different types of packing material used in packed towers. iii) Energy audit for chemical engineering department. <ul style="list-style-type: none"> 1) Mass transfer lab. 2) Heat transfer lab. iv) Collect information are distillation from internal. v) Various universities for higher education. vi) Various job avenue for a student diploma. 	08
Total		32

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING
COURSE CODE : CH
SEMESTER : SIXTH
SUBJECT TITLE : PETROCHEMICAL TECHNOLOGY (ELECTIVE)
SUBJECT CODE : 9213

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPERS HRS	TH	TEST	PR	OR	TW	TOTAL
03	-	02	03	80	20	50@	--	--	150

Rationale:

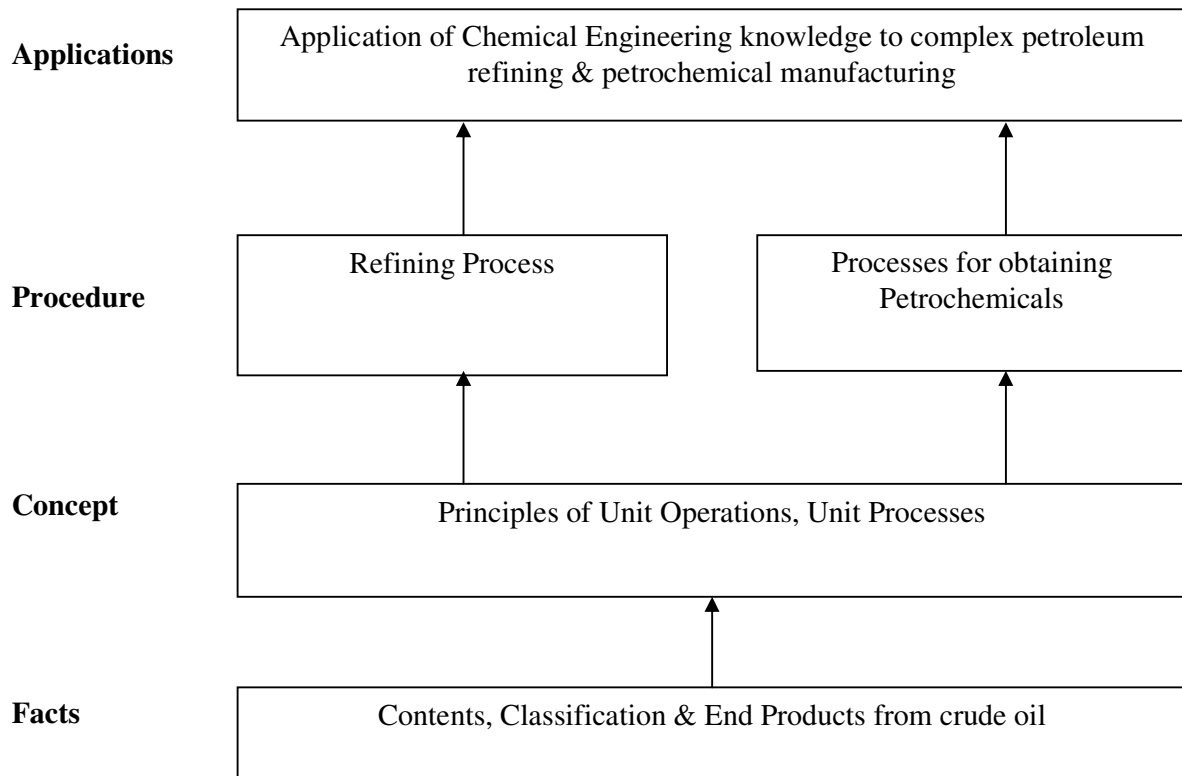
This era belongs to crude oil and various petroleum products and petrochemicals derived from it. Petrochemicals are a vast field with vast potential for employment. This subject is introduced to increase employability of Chemical Engineering students in Petrochemicals & Petroleum Refining field.

Objectives:

Student should be able to:

- 1) Describe refinery operations.
- 2) Know manufacturing of different petroleum end products from crude oil.
- 3) Identify various hazards in petrochemical industry.
- 4) State safety precautions to be taken in petrochemical industries.

Learning Structure:-



Content: Theory

Chapter	Name of the Topic	Hours	Marks
1	Introduction to Petroleum Refining: 1.1 Indian Refineries, Their location and capacity 1.2 Global crude oil producers, 1.3 Characteristics of crude, Composition, constituents of crude oil	08	08
2	Refining: 2.1 Process of Refining of crude oil to obtain various fractions (8 Marks) 2.2 Unit operations used in separation processes- Fractionation, Vacuum Distillation (4 Marks) 2.3 List of Hydrocarbons/ fractions obtained, their Boiling Ranges and their uses (4 Marks)	10	16
3	Unit Processes in Refineries: Flow charts, Reactions, Description 3.1 Hydrogenation, Cracking, Alkylation, Polymerisation, (10 Marks) 3.2 Hydrocracking, Isomerisation, Reforming, Esterification & Hydration. (10 Marks) 3.3 Waste Treatment (8 Marks)	12	28
4	C₁ to C₄ Hydrocarbons: (4 Marks each) 4.1 C ₁ Hydrocarbons, Petrochemicals from C ₁ 4.2 C ₂ Hydrocarbons, Petrochemicals from C ₂ 4.3 C ₃ Hydrocarbons, Petrochemicals from C ₃ 4.4 C ₄ Hydrocarbons, Petrochemicals from C ₄ 4.5 Aromatic Fractions	10	20
5	Hazard & Safety (4 Marks each) 5.1 Hazards in Petrochemical Industry 5.2 Safety in Petrochemical Industry	08	08
TOTAL		48	80

Practical:

Skills to be developed:

Intellectual Skills:

- 1) Interpret test results
- 2) Follow systemic procedure for handling chemicals

Motor Skills:

- 1) To handle equipments/instruments
- 2) To observe physical phenomenon

List of Practicals:-

1. Determination of Aniline Point.
2. Determination of Fire Point, Flash Point.
3. Determination of calorific value.
4. Determination of viscosity index.
5. Preparation of Ethyl Acetate by Esterification.
6. Preparation of PF Resin.
7. Preparation of Biodiesel by Transesterification.
8. ASTM, TVP Distillation.
9. Determination of Drop Point.
10. Determination of Pour Point.

Learning Resources:**Books:**

Sr. No.	Author	Title	Publisher
1	M. Gopala Rao, M. Sittig,	Dryden's Outlines of Chemical Tech	East West Press
2	George Austin	Shreve's Chemical Process Industries	Mc Graw Hill Publication
3	Peter Wiseman	Petrochemicals	John Willey & Sons
4	Bhaskar Rao	Petrochemicals	--

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING
COURSE CODE : CH
SEMESTER : SIXTH
SUBJECT TITALE : FOOD PROCESSING & ENGINEERING (ELECTIVE)
SUBJECT CODE : 9214

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPERS HRS	TH	TEST	PR	OR	TW	TOTAL
03	--	02	03	80	20	50@	--	--	150

Rationale:

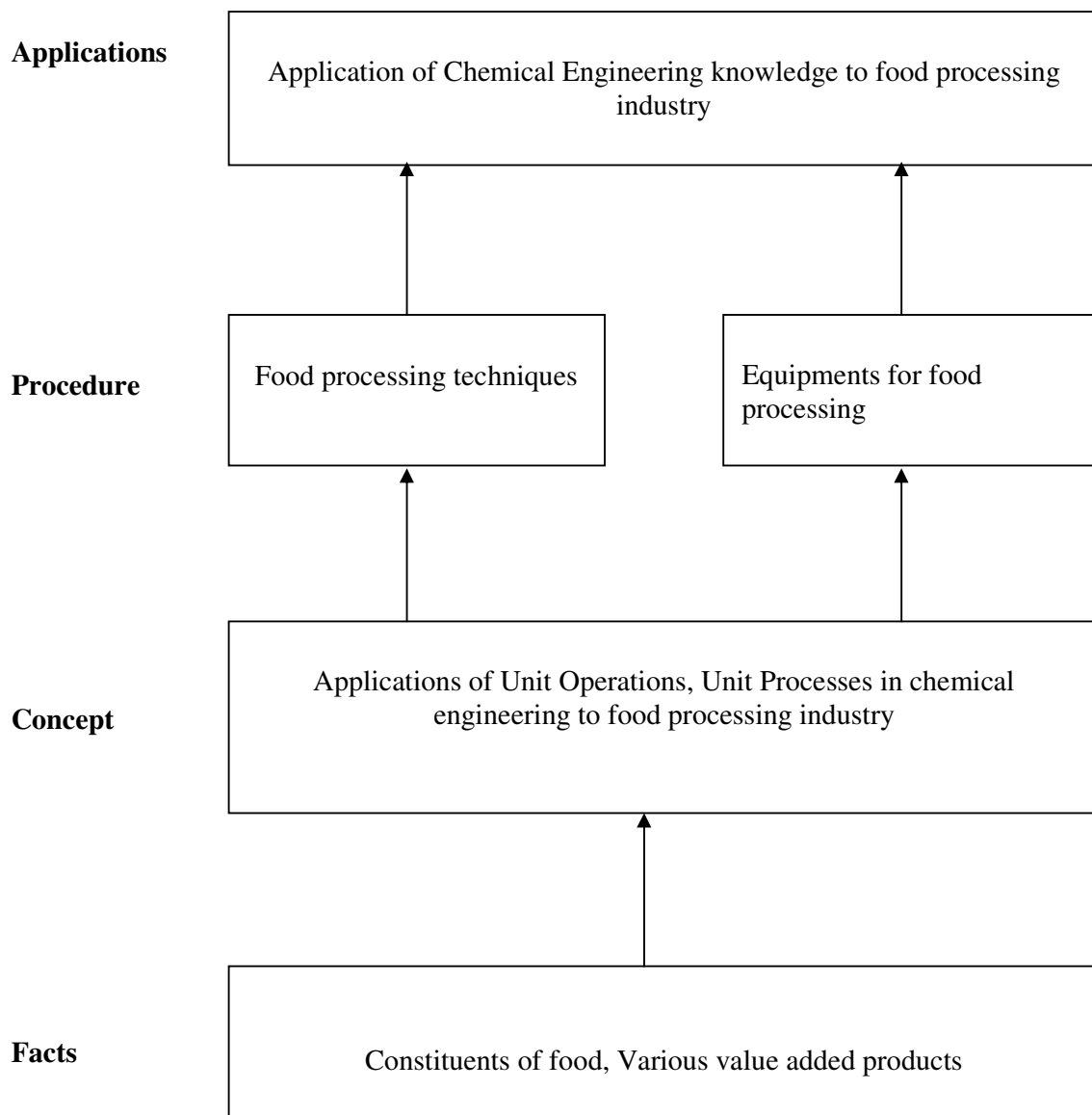
Biotechnology & food processing is a declared thrust area besides IT for economic growth of our country. Food processing is very essential for agriculture-based economy for value addition of the agricultural produce. This subject is introduced to increase employability of Chemical Engineering students in food processing field.

Objectives:

The student will be able to:

- 1) To make students aware of food processing operations.
- 2) To make students aware of Unit Operations and Unit Processes of chemical engineering applied to food processing industry.
- 3) To understand manufacturing processes of different value added food products.
- 4) To know aseptic conditions to be maintained in food processing industry.

Learning Structure:-



Content: Theory

Chapter	Name of the Topic	Hours	Marks
1	Overview of Food Chemistry. Food Constituents: Carbohydrates, Protein, Lipids, Enzymes and water. Vitamins and Minerals. Food Additives.	08	08
2	Classification and terminology of microorganisms. Nutritional requirement of microorganisms. Growth of microorganisms. Factors affecting growth and inhibition of microorganisms in food.	08	08
3	Spoilage and associated chemical / physical changes in food. Basic principles and unit operations in food processing and preservation. Food preservation by high temperature, low temperature, dehydration, evaporation, chemicals, irradiation. Food Packaging.	08	16
4	Process technology of Fruits and Vegetables : Unit operations in processing and canning of fruit and vegetables and their products. Technology of Juice and Beverages, Jams, Jellies, Marmalade, tomato products, pickles and chutneys. Process Technology of Milk and Milk Products : Processing, storage and distribution of milk and milk products. Standards for milk and milk products.	08	16
5	Process Technology of Cereals and Legumes : Process technology of milling of cereals and legumes. By product of Milling Industry. Processing of Malt. Process technology of Baked Goods : Manufacturing of bread, biscuits, cookies and cakes. Quality control in finished product.	08	16
6	Process Technology of Alcoholic Beverages: Types of alcoholic beverages, Raw material, fermentation and processing of alcoholic beverages. Process technology of chocolate and confectionary : Manufacture of chocolates. Types of confectionary products. Production of sugar based and Indian confection.	08	16
TOTAL		48	80

Practical:

Skills to be developed:

Intellectual Skills: 1) Observations

2) Calculations

3) Analysis

4) Aseptic Conditions

Motor Skills: 1) Equipment handling

2) Preparation of food products

List of Practicals:

11. Quantitative determination of carbohydrate, protein and ascorbic acid.
12. Analysis of food materials and food products.
13. Enzymes kinetics study. Culturing of microorganisms. Counting of microorganisms.
14. Growth curve experiments.
15. Processing of fruit and vegetables products like juice, Jams, Jellies.
16. Processing of Marmalade, tomato products, pickles and chutneys
17. Preparation of bakery products like bread, biscuits, cakes.
18. Preparation of confectionary products like soft and hard-boiled candies, fruit candies, chikki etc.
19. Preparation of dairy products.

Learning Resources:**Reference Books:**

Sr. No.	Author	Name of the Book	Publisher
1	L.H. Meyer	Food Chemistry	Van Nostrand Reinhold co., New York
2	Owen R. Fennema	Principles of Food Science, Part I – Food Chemistry	Marcel Dekker Inc, New York
3	Owen R. Fennema	Principles of Food Preservation, Part II	Marcel Dekker Inc, New York
4	Giridharilal and Sidappa	Preservation of Fruits and Vegetables	Indian Council of Agricultural Research, New Delhi.
5	--	Food Industry	IIT, Madras
6	E.E. Conn and P.K. Stumpf Food Microbiology: W.C. Frazier	Outlines of Biochemistry	Tata McGraw Hill publishing Co., New Delhi.
7	British J. and Grosphicree	The Manufacturer of Biscuits, Cakes and Wafers	Sir Isaac Pitman & Sons Ltd. London.
8	E.B. Jackson and Less R	Sugar confectioner and Chocolate Manufacturer	Leonard Hill Books 24 Market Square Alyesbury.
9	Lampert I.M.	Modern Dairy Products	Eurasia Publishing House, Ramnagar, New Delhi.
10	Newlander J.A. and Artherton H.V.	The Chemistry and Testing of Dairy Products	Olsen Publishing Co. Milwalie Wisconsin.
11	David Pearson	Chemical Analysis of Foods	JDA Churchil, London.
12	Ranganna S.	Manual of Analysis of Fruits and Vegetables Products	McGraw Hill publishing Co., New Delhi.

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING
COURSE CODE : CH
SEMESTER : SIXTH
SUBJECT TITLE : SUGAR TECHNOLOGY (ELECTIVE)
SUBJECT CODE : 9215

Teaching & Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPERS HRS	TH	TEST	PR	OR	TW	TOTAL
03	--	02	03	80	20	50@	--	--	150

Rationale:

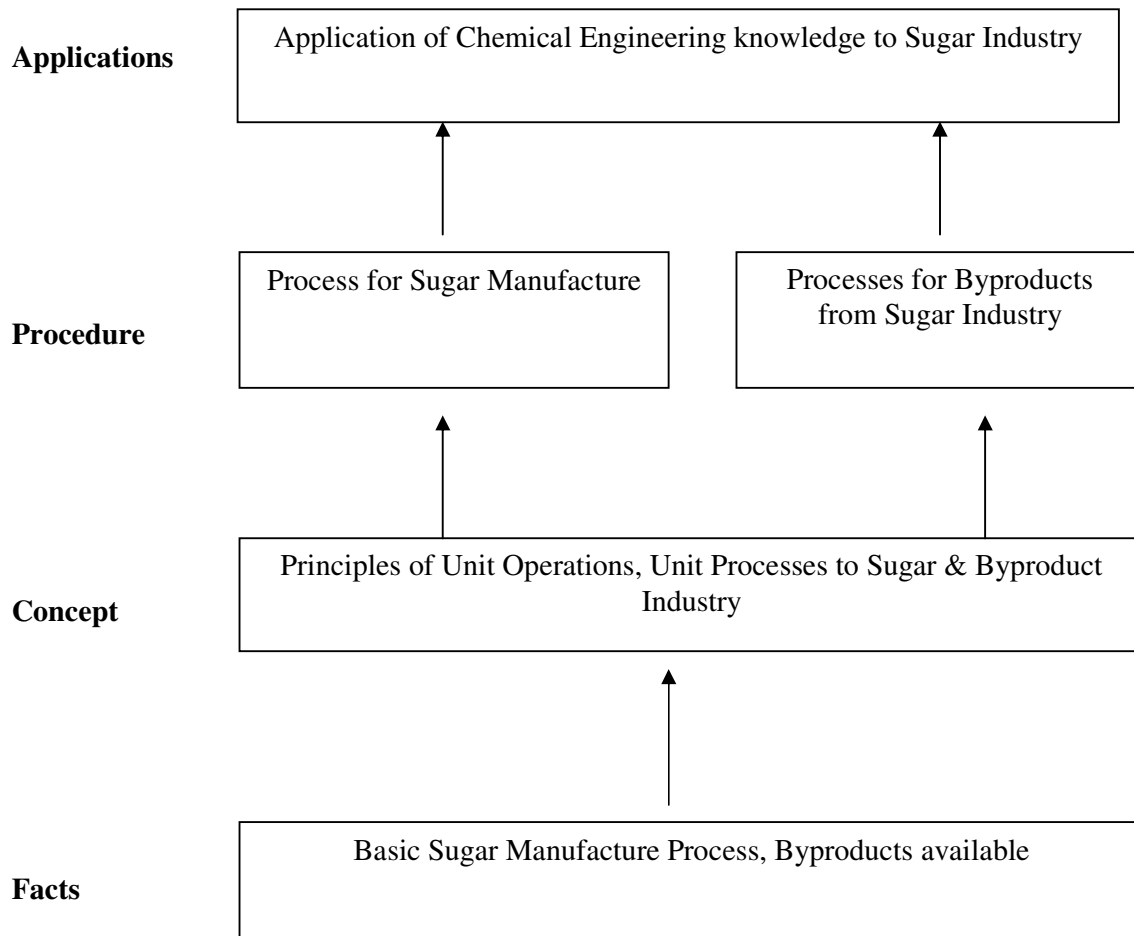
Sugar Technology is an upcoming field with wide scope for employment. Apart from Sugar, Ethanol is in huge demand for blending with Petrol. Chemical Engineers are being employed in this sector. This subject is introduced to increase employability of students in Sugar Technology field.

Objectives:

The students should be able to:

1. Know position of Maharashtra in Sugar scenario of India.
2. Know Unit processes of Chemical Engg used in Sugar Industry
3. Know Renewable Agro based feedstock and Chemicals based on molasses and ethanol.

Learning Structure:-



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1	Introduction 1.1 Sugarcane producing states in India 1.2 Cultivating factors affecting sugarcane quality 1.3 Harvesting	03	04
2	Manufacture of Sugar 2.1 Chemical composition of juice, methods of polarization (04Marks) 2.2 Extraction of juice, Brix curve (04 Marks) 2.3 Juice treatment (08 Marks) <ul style="list-style-type: none"> • Screening • General constituents of juice from immature cane • Process of treatment – Defecation, Sulphitation • Ion exchange 2.4 Multiple effect evaporation (12 Marks) <ul style="list-style-type: none"> • Working of evaporators • Evaporators- Forward, Backward, Mixed feed • Falling film evaporators • Cleaning of evaporators- Methods 2.5 Crystallization (08 Marks) <ul style="list-style-type: none"> • Principle of crystallization • Types of crystallizer and their working • Crystallization calculations 	15	36
3	Cane sugar Refining 3.1 Affination, clarification/defecation (8 Marks) 3.2 pH adjustment (4 Marks) 3.3 Decolonization- char filtration (4 Marks)	12	16
4	Byproducts of sugar Industry 4.1 Use of Bagasse [Processes of Biogas, Bio manure, Pulp & paper, Particle board, as fuel, Bagasse ash] (8 Marks) 4.2 Composition & uses of Molasses [Fermentation, abs. Alcohol, rectified spirit & cattle feed] (4 Marks) 4.3 Ethanol as a fuel- properties & advantages (4 Marks) 4.4 Sugar based Industries [Processes of Confectionary, sugar candies, Indian sweets, sugar cubes]- (8 marks)	18	24
Total		48	80

Practicals:

Skills to be developed:

- Intellectual Skills: 1) Interpret test results.
2) Follow systemic procedure for handling chemicals.

- Motor Skills: 1) To handle equipments/instruments.
2) To observe physical phenomenon.

List of Practicals:

1. Determination of Brix & Purity of juice
2. Determination of moisture present in white sugar
3. Determination of grade & color of white sugar
4. Determination of SO₂ content in white sugar
5. Determination of phosphate content of juice
6. Determination of CO₂ % in limestone
7. Determination of active CaO in lime
8. Determination of true sucrose of gur
9. Determination of ash% of gur
10. Determination of viscosity of sucrose solution & molasses

Learning Resources:**Books:**

Sr. No	Author	Title	Publisher
1	N.C. Verma	System of Technical Control	STA of India, New Delhi
2	P.Hoing	Principle of Cane Sugar Technology	Elsevier Publisher Co. London
3	K.C.Banerjee	Cane sugar factory control	M.L.Kakar,Hazratganj,Lucknow
4	J.H.Payne	Sugarcane factory analytical control	Elsevier Publisher Co. London
5	Jenkins	Introduction to sugarcane technology	Elsevier Publisher Co. London

COURSE NAME : DIPLOMA IN CHEMICAL ENGINEERING
COURSE CODE : CH
SEMESTER : SIXTH
SUBJECT TITLE : BIOPROCESS ENGINEERING (ELECTIVE)
SUBJECT CODE : 9216

Teaching & Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TUE	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
03	--	02	3	80	20	50@	--	--	150

Rationale:

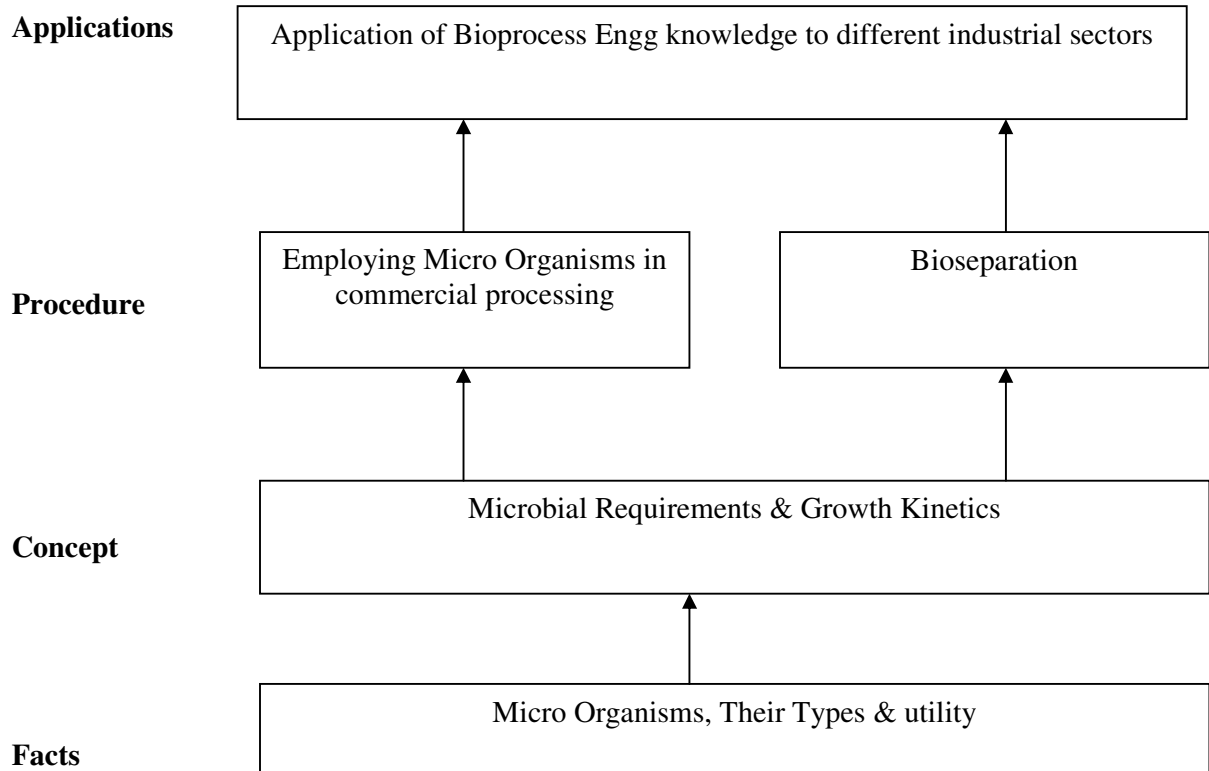
Biotechnology is a declared thrust area besides IT for economic growth of our country. Bioprocess engineering is very essential for agriculture-based economy for maximum output from limited resources of the agricultural sector. This subject is introduced to increase employability of Chemical Engineering students in biotechnology field.

Objectives:

Students will be able to:

1. Understand basic terminology and biotechnology principles.
2. Apply knowledge of Unit Operations and Unit Processes of Chemical Engineering to bioprocess industry.
3. Use processes carried out in bioreactor.
4. Apply knowledge of bioprocess engineering.

Learning Structure:-



Details Contents:

Chapter	Name of the Topic	Hours	Marks
1	General reaction kinetics for biological system.(08 Marks) <ul style="list-style-type: none"> • Enzyme Kinetics • Michaleis-Menten kinetics • Determination of enzyme kinetic constants • Kinetics of enzyme deactivation. Immobilization of enzymes and cells. (04 Marks) Kinetics of Microbial growth. (04 Marks) Death rate kinetics (04 Marks)	06	20
2	Stoichiometry <ul style="list-style-type: none"> • Thermodynamics of bio system • Material and energy balances (Problems) 	06	08
3	Sterilization Design, preparation and sterilization of media. Air sterilization.	10	08
4	Bioreactor Bioreactor Configuration. Practical consideration for bioreactor configuration. Monitoring and control of bioreactors. Ideal Reactor operation. Scale up of bioreactor systems.	08	12
5	Diffusion <ul style="list-style-type: none"> • Role of diffusion in bio processing. • Oxygen uptake in cell culture. (04 Marks) • Oxygen transfer in fermenters. (04 Marks) • Measuring dissolved oxygen concentration. (04 Marks) • Mass transfer correlation. Measurement of $K_{L,a}$. (04 Marks) 	10	16
6	Bio separation <ul style="list-style-type: none"> • Down stream processing and bio separation. (08 Marks) • Waste water treatments. (08 Marks) 	08	16
Total		48	80

PRACTICAL:

Intellectual Skills:

1. Observations
2. Cultivation of micro organisms
3. Analysis of growth
4. Aseptic Conditions

Motor Skills

1. Equipment handling
2. Preparation of aseptic conditions

LIST OF PRACTICALS:

1. Preparation and Sterilization of Media.
2. Microscopic Examination of different groups of Micro-organisms.
3. Growth and enumeration of Micro-organisms.
4. Aseptic Techniques.
5. Assay of enzyme activity and specific activity.
6. Kinetic analysis of an enzyme catalyzed reaction.
7. Determination of $K_L a$ and dissolved oxygen.
8. Study of fermentation processes and controls.
9. Immobilization of enzymes and whole cells.

LEARNING RESOURCES:**Books:**

Sr. No	Author	Title	Publication
1	Ghose T.K	Bioprocess Computations in Biotechnology	Eiils Horwood Ltd
2	Bailey Jams E. and Oils D.F.	Biochemical Engineering Fundamental	McGraw Hill Book Co.
3	Pauline M. Doran	Bioprocess Engineering Principles	Academic Press Limited, London
4	Aiba, Arthur E. Humphery and Nancy F. Millis	Biochemical Engineering	University of Tokyo Press.