Veermata Jijabai Technological Institute (V.J.T.I)

(Central Technological Institute, Maharashtra State, INDIA)

H. R. Mahajani Marg, Matunga, Mumbai 400019

Tel.No. +91 22 24198101-02 Fax: +91 22 24102874

Website: www.vjti.ac.in

Programme: Diploma in CHEMICAL ENGINEERING (DCHE) **Semester: V** **Implemented from: 2017**

COURSE CODE	COURSE	GR	TEACHING SCHEME (HRS/WK)				EXAMINATION SCHEME												
			L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
								Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
175CH51	Industrial Training (6 weeks in summer break after 4 sem)	A	-	-	6#	6#	-	-	-	-	-	-	-	-	75*	30	75	30	150
175CH52	ENVIRONMENT POLLUTION AND CONTROL	A	4	-	3	7	3	80	32	20	100	40	25*	10	-	-	25	10	150
175CH53	CHEMICAL PLANT SAFETY AND LOSS PREVENTION	A	4	-	-	4	3	80	32	20	100	40	-	-	-	-	50	20	150
175CH54	HEAT TRANSFER	C	4	2	3	9	3	80	32	20	100	40	50*	20	-	-	50	20	200
175CH55	INSTRUMENTATION AND PROCESS CONTROL	C	3	-	2	5	3	80	32	20	100	40	25*	10	-	-	25	10	150
175CH56	ELECTIVE (ANY ONE)	A	3	-	-	3	3	80	32	20	100	40	-	-	-	-	-	-	100
175CH57	PROJECT-I	A	-	-	3	3	-	-	-	-	-	-	-	-	50*	20	50	20	100
	TOTAL		18	2	11	31	-	400	-	100	500	-	100	-	125	-	275	-	1000

Abbreviations: B – Basic; C – Core; A – Applied; M – Management; L – Theory Lecture; T – Tutorial; P – Practical; TH – Theory Paper; IST – In-Semester Tests (02); PR – Practical Exam; OR – Oral Exam; TW- Term Work.

*** Indicates assessment by External Examiner**

(#): Evaluation of industrial training and its reports will be done in 5th semester and the credits for same will be included in 5th semester mark sheet. The teaching load assigned to a faculty member for guiding students in preparation of training report and its evaluation for a batch of students (equivalent to practical batch size) would be 1 hour/week in 5th semester.

Curriculum Coordinator	Head	Dean - Diploma
	Diploma in CHEMICAL ENGINEERING (DCHE)	

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Programme: Diploma in CHEMICAL ENGINEERING (DCHE) **Semester: V** **Implemented from: 2017**

LIST OF ELECTIVE SUBJECTS

SR NO	SUBJECT
1	Membrane Technology
2	Renewable Energy Technologies
3	Industrial Management (Finance aspect)
4	Numerical Methods in Chemical Engineering
5	Fertilizer Technology
6	Biochemical Technology

Dean (Diploma)

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE, MATUNGA, MUMBAI - 400 019. T & A Chemistry Department

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	:INPLANT TRAINING
COURSE CODE	:175CH51

TEACHING AND EXAMINATION SCHEME:

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
-	-	6	6	-	-	-	-					75	30	75	30	150

Course Objectives:

To understand the various domains of industry along with exposure to work environment and latest developments in technologies

Course Outcomes:

Student should be able to

CO1	Understand scope and functions of various industrial aspects viz. manufacturing processes, maintenance schedule, productivity improvement, quality control, team work and job responsibility in various departments
CO2	Develop work culture, industrial practices, organizational behavior and ethics, safety and environment awareness
CO3	Interpret and solve routine technical problems through application of engineering principles
CO4	Integrate theory with practice with the help of industrial practitioner
CO5	Develop leadership and management skills

Course Content:

Methodology

The students shall undergo inplant training for 6 weeks in between fourth and fifth semesters in any Chemical/ Petroleum/ Pharmaceutical. A faculty mentor shall be assigned to each student undergoing training for guidance and monitoring during the training period. The

student shall carry out detailed study of different activities in various departments and try to locate the problem areas. The student shall maintain a daily diary and record in brief the observations made, work problems in section/ project undertaken, literature referred, data etc,which shall be countersigned by the section in-charge or industry officer. The student shall submit the certificate for satisfactory completion of training for the entire duration received from the training organization after completion of training. The student shall submit typed and bound training report to the faculty mentor for assessment. The students will be examined through viva-voce by the internal and external examiners.
(The external examiner should be from industry).

3.5 Specific areas of study and working: -

Students are required to collect the relevant information on the specific area given below. This information should be recorded in daily diary and further used in preparing the Final Report.

Areas as per program discipline:

- Chemical Manufacturing Process
- Various Chemical Operations as Distillation, crystallization, Drying etc
- Common procedure for downstream processing
- Effluent treatment processes

Training Monitoring

The student shall update the faculty mentor regarding the training undertaken every week. The student shall submit his daily dairy to faculty mentor for assessment.

Assessment

Each student shall submit a typed and bound inplant training report along with the copy of training completion certification received from the industry within 15 days after completion of industrial training. The term work assessment shall be done by internal examiner only. The students shall give presentation of work done by them in industry during training period and shall be assessed for the oral and presentation byexternal and internal examiners.

Curriculum Coordinator **Head** **Dean - Diploma**

Diploma in CHEMICAL ENGINEERING

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE, MATUNGA, MUMBAI - 400 019
T & A
Chemistry
Department

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: ENVIRONMENT POLLUTION AND CONTROL
COURSE CODE	: 175CH52

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME												
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
4		3	7	3	80	32	20	100	40	25*	10	-	-	25	10	150

Course Objectives:

1. Understand the types of pollution & controlling methods
2. Understand the procedure for environmental monitoring

Course Outcomes:

Student should be able to

CO1	Understand the types of pollution and pollutants
CO2	Know working of different equipment used to control the air and water pollution.
CO3	Know waste treatment methods for specific industries and Understand disposal methods of solid waste management.
CO4	Understand the procedure for environmental audit and norms of ISO 14000.

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Air Pollution**	**20**	**18**	**1**	**40%**	**40%**	**20%**
	1.1	Air pollution : definition and classification of air pollutants. Natural and Manmade sources of pollution (CO, CO_2, SOx, NOx, Particulates, Hydrocarbons,O_3) Effect of air pollution on health, animals, material and vegetation Air Quality monitoring: CPCB Air quality standards (SOx, NOx, SPM,CO)						

	1.2	Necessity of air sampling and Basic consideration during sampling. Sampling methods for gaseous and particulate type pollutants: Gaseous pollutants: Grab sampling, Absorption, Adsorption, Freeze out sampling Particulate pollutants: dust fall jar, high volume sampler, electrostatic precipitation.						
	1.3	Methods of controlling air pollution:- Air pollution controlling methods, Principle, construction, working and application of Equipment for gaseous pollutants control: Gas absorption equipment: Packed column, Plate column and venture scrubber, Fixed bed absorber, Thermal and catalytic incinerator. Principle, construction, working and application of Equipment for particulate types of pollutants control:- Gravity settling chamber, Cyclone separator, Fabric filter, Wet Scrubber, Electrostatic precipitator						
2		**Water Pollution and Waste Water Treatment**	**22**	**22**	**2**	**40%**	**40%**	**20%**
	2.1	Waste water characteristics Types of water pollutants and their sources & effects. Physical, chemical & biological characteristics of Wastewater. Water sampling methods: Grab sampling and composite sampling. Concepts & significance: DO, TSS, TDS, pH, BOD, COD etc . Drinking water quality standard (MPCB/WHO) Role of pollution control board						
	2.2	Effluent treatment methods:- Preliminary Treatment, Primary Treatment, secondary (Biological) Treatment: Principle, construction & working of Trickling Filters and Activated sludge Treatment plant						
	2.3	Sludge treatment:- Sludge Thickening, Sludge Digestion, Sludge Dewatering, Sludge Disposal						
SECTION-II								
3		**Industry Specific Waste Treatment**	**06**	**12**	**3**	**40%**	**40%**	**20%**
	3.1	**Fertilizer Industry** Names of pollutants produced from urea plant and their effects. Treatment of solid, liquid, gaseous effluent produced in urea Plant.						
	3.2	**Pulp & Paper (Kraft) Industry** Problems of black liquor and Recovery of chemicals from black liquor						

4		**Solid Waste Management**	**10**	**16**	**3**	**40%**	**40%**	**20%**
	4.1	Solid waste : Definition, classification, characteristics and origin. Solid waste collection methods. Solid waste processing. Reuse, recycle and recovery.						
	4.2	Disposal of Biomedical waste.						
5		**Environmental Audit & ISO 14000**	**06**	**12**	**4**	**40%**	**40%**	**20%**
	5.1	Environmental management: Principle, objective and components of Environment management.						
	5.2	Environment Audit :principle, Procedure and benefits						
	5.3	ISO 14001: Need for ISO 14001. Business Benefits of ISO 14000						
		Total	**64**	**80**				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).								

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of Assignments/Tutorials:

Sr. No.	Unit	Practical/Assignment	Approx. Hours	CO
1	1	Estimate suspended particulate matter in air using high volume sampler.	3	1
2	1	Estimate concentration of flue gas using orsat apparatus.	3	1
3	2	Measure the turbidity of given waste water sample using nephlometric turbidity meter.	3	2
4	2	Determine total hardness of the given effluent sample using Ethylene Diamine Tetra Acetic Acid (EDTA).	3	2
5	2	Determine total suspended solids and total dissolved solids in given effluent sample.	3	2
6	2	Determine acidity and alkalinity of given effluent sample.	3	2
7	2	Estimate chloride content of given water sample.	3	2
8	2	Determine biological oxygen demand (BOD) of the given effluent sample.	3	2
9	2	Determine chemical oxygen demand (COD) of the given effluent sample by spectrophotometer.	3	2
10	2	Determine dissolved oxygen of the given effluent sample.	3	2
11	3	Visit nearby chemical industry and prepare a report on effluent treatment plant.	3	3

Text Books :

Sr. No.	Author	Title	Publisher and Edition
1	Text Book of Environmental Pollution and Control	Dr. H. S. Bhatia	New Delhi Galgotia Publication.
2	A Text Book of Environmental Chemistry and Pollution Control	Mr. S. S. Dara	S. Chand & Company Ltd. New Delhi.
3	Environmental Pollution Control Engineering	C. S. Rao	New Age International(P) Limited, P:-ublishers
4	Pollution Control in Process Industries	Mr. S. P. Mahajan.	Tata Mc Graw Hill, New Delhi.

Reference books:

Sr. No.	Author	Title	Publisher and Edition
1	Waste water Engineering: Treatment, Disposal & Reuse	Metcalf & Eddy	Tata McGraw Hill, NewDelhi.

Weblinks:

1. https://nptel.ac.in/courses/103107084/
2. https://nptel.ac.in/courses/105106119/

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: CHEMICAL PLANT SAFETY AND LOSS PREVENTION
COURSE CODE	: 175CH53

Teaching & Examination Scheme

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
4	-	-	4	3	80	32	20	100	40	-	-	-	-	50	20	150

Course Objectives:

1. To understand the importance of plant safety.
2. To understand the Knowledge of plant safety

Course Outcomes:

Student should be able to

CO1	Describe the safety procedures to be observed while working in a plant.
CO2	Identify types of hazards associated in a chemical process industry.
CO3	Prepare safety audit report & safety report.
CO4	Explain procedure for preventive maintenance, on-line maintenance, shut down maintenance.

Course Content:

SECTION I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Personal Protective equipments**	**08**	**10**	**1**	**40%**	**40%**	**20%**
	1.1	Non respiratory personal protective equipment:- Eye & Face, ear, head, torso & body, hand, foot & leg protection.						
	1.2	Respiratory protective equipment:- Air purifier type, supplied air type, Self contained breathing apparatus, Selection of proper devices.						
2		**Fire Prevention**	**10**	**14**	**1**	**40%**	**40%**	**20%**
	2.1	Types of fire, fire triangle, Principle of extinguish of fire. Classification of fire and suitable type of extinguisher.						

	2.2	Principle, Construction & working of fire extinguisher – Soda Acid type, Foam type, Dry Chemical powder. Fire buckets and Fire hydrant.						
3		**Plant Hazards**	12	16	2	40%	40%	20%
	3.1	Industrial hazards Industrial hazards due to process & its precautions, Plant Safety provisions.						
	3.2	Electrical hazards - Common Sources, precautions. Mechanical hazards Static Hazards (electricity)						
	3.3	Explosion hazards - Classification of explosives, precautions while handling explosives. Radiation hazards – Health hazards of infrared radiation & X rays.						
		SECTION II						
4		**Storage & Transportation of Chemicals**	10	12	1	40%	40%	20%
	4.1	**Methods of Storage** Bulk storage, bin storage, underground storage, liquid storage, gas storage; Storage of flammable & combustible liquid chemicals shock sensitive chemicals. Packing of solids - bags, boxes, drum, container. Vibrating hopper, Screw feeder.						
	4.2	**Functions & Principles of material handling.** Transportation of hazardous Chemicals – Flammable liquids, corrosives or oxidizing materials, water reactive Chemicals, igniting substances, toxic chemicals.						
5		**Safety Audit**	06	08	3	40%	40%	20%
	5.1	Objectives of safety audit, procedure for safety auditing.						
	5.2	Case study(Accidental analysis)						
6		**Plant Maintenance**	18	20	4	40%	40%	20%
	6.1	Objectives of plant maintenance functions & responsibilities of plant maintenance department.						
	6.2	Types of maintenance Corrective or breakdown maintenance, Scheduled maintenance, Preventive maintenance, Predictive maintenance.						

6.3		Online maintenance (eg. Rota meter/ Steam trap), Shut down maintenance, Procedure for shutdown & start up of plant.						
		Total	**64**	**80**				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).								

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

Text Books:

Sr. No.	Author	Title	Publisher and Edition
1	Safe Handling of Hazardous Chemicals	A. K. Rohatgi	J. K. Entrprises
2	Plant Maintenance	S. S. Apte	Delhi Productivity Council
3	Plant Safety and Maintenance	D.B.Dhone	Nirali Publications

Reference Books:-

Sr. No.	Author	Title	Publisher and Edition
1	Safety & Accident Prevention in Chemical operations	H. H. Foucet & W. S. wood	Inter Science Publication, John Willey & Sons
2	Safety in Process Plant Design	G. L. Wells	John Willey & Sons
3	Maintenance Engineer Handbook	C. L. Morrow	McGraw Hill Publication

Weblinks:

1. https://nptel.ac.in/syllabus/103102023/
2. https://nptel.ac.in/courses/103106071/6
3. https://nptel.ac.in/syllabus/103106071/

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: HEAT TRANSFER
COURSE CODE	: 175CH54

Teaching & Examination Scheme

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
4	2	3	9	3	80	32	20	100	40	50*	20	-	-	50	20	200

Course Objectives:

1. Understand concept and principles of heat transfer operations.
2. Understand control of various parameters, which affect the operations

Course Outcomes:

Student should be able to

CO 1	Understand basic modes , mechanism and laws of heat transfer
CO 2	Know concept of overall and individual heat transfer coefficient and to calculate rate of heat transfer.
CO 3	Calculate rate of heat radiated between two surfaces.
CO 4	Explain working of different heat transfer equipments, evaporators and crystallization.

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Conduction**	12	14	1	40%	40%	20%
	1.1	Modes of heat transfer - definition with examples						
	1.2	Fourier's law - statement, mathematical expression						
	1.3	Thermal conductivity - definition, relation with temperature.						
	1.4	Description of steady state conduction						
	1.5	Derivation of rate of heat flow by conduction through rectangular block, composite wall & numerical.						
	1.6	Derivation of rate of heat flow through cylinder, sphere & numericals						
	1.7	Study of variation of thermal conductivity with temperature						
	1.8	optimum thickness of insulation - concept & definition						

2		**Convection**	**20**	**20**	**2**	**40%**	**40%**	**20%**
	2.1	Natural & forced convection – definition & example						
	2.2	Film coefficient – concept, definition and unit Derivation of overall heat transf er coefficient from hot fluid to cold fluid through metal wall						
	2.3	Derivation of overall heat transf er coefficient from hot fluid to cold fluid through metal wall. Effect of surface coefficient on overall heat transfer coefficient						
	2.4	Dimensional analysis for heat transfer for understanding the use of Reynold's number, prandtl number, Nusselt number and Grashoff number in calculating film coeffitient						
	2.5	Calculating heat transfer coefficient in laminar & turbulent flow by Dittus –Bolter & Sider Tate equation						
	2.6	Co-current & counter current heat flow- concept, schematic representation & comparison						
	2.7	Concept of Log Mean Temp. Difference, derivation & numericals based on this						
	2.8	Boiling – definition of saturated pool boiling, boiling curve, study of film boiling, nucleate boiling & transition boiling						
	2.9	Condensation – definition, Dropwise & filmwise definition & relative merits & demerits, effect of vertical & horizontal heat transfer surface on heat transfer.						
3		**Radiation**	**04**	**06**	**3**	**40%**	**40%**	**20%**
	3.1	Radiation- Definition & examples						
	3.2	Definition of absorptivity, reflectivity and transmissivity						
	3.3	Laws of radiation- statement & mathematical expression of Plank's Law, Wien's displacement law, Stefan Boltzman law						
	3.4	Definition, mathematical expression & description of Kirchoff's law Mathematical expression for rate of radiation between two surfaces, numericals based on that						
	3.5	Definition of black body, Gray body, emissivity, Emissive power						
		SECTION II						
4		**Heat Transfer Equipment**	**12**	**16**	**4**	**40%**	**40%**	**20%**
	4.1	Different heat transfer equi pment in chemical industry- names & uses						
	4.2	Double pipe Heat Exchangers- Diagram, construction, working						
	4.3	Shell & Tube Heat Exchanger- Diagram, construction, working of different types						
	4.4	Single pass & multipass heat exchangers- Working& comparison						

	4.5	Diagram of 1-2 & 2-4 heat exchanger						
	4.6	Graphite Block heat exchanger - Diagram, construction, working						
	4.7	Extended Surface heat exchanger - Diagram, construction, working						
	4.8	Scrapped Surface heat exchanger - Diagram, construction, working						
	4.9	Plate type heat exchanger - Diagram, construction, working						
	4.10	Design procedure for heat exchangers (No numerical)						
5		**Evaporation**	**12**	**14**	**4**	**40%**	**40%**	**20%**
	5.1	Definition of evaporation, comparison of Evaporation & Drying						
	5.2	Statement & effects of properties that influences evaporation						
	5.3	Definition & description of capacity & economy of evaporator, methods to improve economy						
	5.4	Feeding of multiple effect evaporator – description & diagram						
	5.5	Mechanical & thermal recompression description & diagram						
	5.6	Material & enthalpy balance for single effect evaporator, numerical based on this topic to calculate area of evaporator.						
	5.7	Detailed study of construction, working, diagram & application of open pan evaporator, Horizontal tube evaporator, Vertical tube evaporator, Long tube vertical evaporator, forced circulation evaporator.						
6		**Crystallization**	**04**	**10**	**4**	**40%**	**40%**	**20%**
	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) crystallizer, Swenson Walker crystallizer.						
	6.4	Simple material balance, numericals on crystallization.						
		Total	**64**	**80**				

Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of Practicals/Assignments/Tutorials:

Sr. No.	Unit	Practical/Assignment	Approx. Hours	CO
1	1	Calculate the thermal conductivity of solid metallic rod.	3	1
2	1	Calculate the rate of heat loss through composite wall.	3	1
3	2	Calculate heat transfer coefficient for natural convection.	3	2
4	2	Calculate Heat Transfer coefficient for forced convection.	3	2
5	3	Calculate the emissivity of a material.	3	3
6	4	Calculate the overall heat transfer coefficient for double pipe heat exchanges for cocurrent flow.	3	4
7	4	Calculate the overall heat transfer coefficient for double pipe heat exchanges for counter current flow.	3	4
8	4	Calculate the overall heat transfer coefficient for 1-2 shell and tube heat exchangers.	3	4
9	4	Calculate the overall heat transfer coefficient for finned tube heat exchangers.	3	4

Sr. No.	Unit	Tutorial	Approx. Hours	CO
1	1	To find out the thermal conductivity of solid metallic rod. (Problems)	3	1
2	1	To find out the rate of heat loss through composite wall.	3	1
3	2	To find out the parameters related to heat exchanger.	3	2
4	2	To find out Heat Transfer coefficient for natural convection forced	3	2
5	3	To find out the emissivity of a material.	3	3
6	4	To find out the overall heat transfer coefficient for types of heat exchanges according to flow.	3	4
7	4	To find out the area of evaporators.	3	4
8	4	Numericals based on crystallization.	3	4

Text books:

Sr. No.	Author	Title	Publisher
1	Heat Transfer Operations	K.A.Gavane	Nirali Publications
2	Heat Transfer and Mass Transfer Operations	Dr. S.D.Dawande	Central Techno Publications
3	Solved problems in mass and heat transfer	G. K. Roy	Khanna Publication

Reference Books

Sr. No.	Author	Title	Publisher
1	Introduction to Chemical Engg.	Mr. Walter L. Badger & Mr. Julius T. Bachero	Mc Graw Hill International.
2	Unit Operations of Chemical Engineering	Mc Cabe, W. L. Smith & Hariot.	Mc Graw Hill International
3	Process Heat Transfer	Kern D. Q.	Mc Graw Hill International.

Weblinks:

1. https://nptel.ac.in/courses/103103032/

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE, MATUNGA, MUMBAI - 400 019. T & A Chemistry Department

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: INSTRUMENTATION AND PROCESS CONTROL
COURSE CODE	: 175CH55

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
3	-	2	5	3	80	32	20	100	40	25*	10	-	-	25	10	150

Course Objectives:

1. Understand the principles of process parameters like temperature, pressure, level, flow.
2. Understand to control the process parameter as per the desired value for the optimization of the process.

Course Outcomes:
Student should be able to

CO1	Understand the principles & working of different measuring instrument.
CO2	Select proper instrument for measuring desired parameters.
CO3	Calibrate and Maintain process control elements.
CO4	Use Controllers, PLC & DCS in process Industry.

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Basic Concepts**	**04**	**06**	**1**	**40%**	**40%**	**20%**
	1.1	Measurement and its aim Functional elements - Primary, Secondary, Manipulating, data transferring.						
	1.2	Static characteristics - definition of Calibration, Accuracy, Precision, Repeatability, Drift, Sensitivity, Resolution, Dead zone, Static error.						
	1.3	Dynamic Characteristics - definition of Speed of response, fidelity, lag, Dynamic error.						

2		**Temperature Measurement**	06	10	2	40%	40%	20%
	2.1	Temperature Scales;- Centigrade, Kelvin, Fahrenheit, Rankin Methods of Temperature Measurement.						
	2.2	Expansion Thermometer- Bimetallic thermometer, Glass thermometer.						
	2.3	Electrical temperature measuring instruments- RTD, thermocouple & Thermistor.						
	2.4	Pyrometer- Optical & Radiation.						
3		**Pressure Measurement**	08	14	2	40%	40%	20%
	3.1	Units of Pressure Methods of Pressure Measurement						
	3.2	Elastic Pressure Transducer - Bourdon tube, Bellows, Diaphragm Force-balance Pressure Gauges - Dead weight tester,						
	3.3	Electrical Pressure Transducer - Strain gauge, LVDT, Measurement of Vacuum - McLeod gauge						
4		**Level Measurement**	06	10	2	40%	40%	20%
	4.1	Methods of Liquid level Measurement Direct Methods:- Sight Glass, Float						
	4.2	Indirect Methods:- Pressure gauge, Air purge, Radioactive, Ultrasonic,Capacitive. Solid level Measurement.						
		SECTION-II						
5		**Flow Measurement**	06	10	2	40%	40%	20%
	5.1	Method of flow measurement Inferential Flow Measurement:- Variable head- flow nozzles, Variable area- Piston type, Magnetic meter, Turbine meter, Ultrasonic flow meter.						
	5.2	Quantity Flow meter:- Positive displacement meters- Rotating vane meter, Mass Flow meters :- Thermal flow meter.						
6		**Process Control System & Controller**	08	12	3	40%	40%	20%
	6.1	Open, closed loop system, cascade control system. Servo & Regulatory operation.						
	6.2	Definition of system - input step, ramp, sinusoidal, pulse.						
	6.3	Selection of Control Action -On-Off, proportional, integral, derivative.						
	6.4	Construction and working of Pneumatic Controllers - P, PI, PD, PID						
7		**Control Valve**	06	12	3	40%	40%	20%
	7.1	Types of control valve – air to open, air to close						
	7.2	Valve characteristics.- Linear, Equal %, Quick opening Valve types- single seated, Double seated						

	7.3	Valve actuators. Valve selection and sizing.						
8		**Computer-Aided Measurement & Control System**	**04**	**06**	**4**	**40%**	**40%**	**20%**
	8.1	Elements of computer-aided measurement and control. Computer aided process control Architecture - Distributed Digital Control Architecture.						
	8.2	Computer- aided process control hardware. Programmable Logic controller (PLC) Architecture. Distributed Control System (DCS) Architecture.						
		Total	**48**	**80**				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).								

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of Practicals/Assignments/Tutorials:

Sr. No.	Unit	Practical/Assignment	Approx. Hours	CO
1	2	Use of Thermocouple or Resistance Temperature Detector or Thermistor to measure the temperature of water bath and understand the characteristics of Thermocouple or Resistance Temperature Detector or Thermistor.	2	2
2	2	Measure of high temperature using radiation or optical pyrometer.Find the range of the optical or radiation pyrometer	2	2
3	3	Use of Linear Variable Differential Transformer (LVDT) to measure pressure.	2	2
4	3	Calibrate the pressure gauge using the dead weight pressure tester.	2	2
5	5	Measure the flow rate by magnetic flow meter.	2	2
6	6	Understand the concept of temperature controller with ON-OFF controller	2	3
7	7	Understand the characteristics of control valve.	2	3
8	8	Understand the operation of DCS /PLC through industrial visit.	2	4
9	4	Determine the liquid level in vessel by capacitance method	2	2
10	3	Measure the pressure using stain gauge transducer, Find the minimum and maximum range.	2	2
11	6	Study of P, PI and PID controllers.	2	3
* Minimum 8 and maximum 12 practicals/experiment sessions to be included in a course in a term.				

Text Books:

Sr. No.	Author	Title	Publisher and Edition
1	Industrial Instrumentation and control	S. K. Singh	Tata McGraw Hill Publishing Company Ltd.
6	Process instrumentation and control.	A.P.Kulkarni	Nirali Publications

Reference books:-

Sr. No.	Author	Title	Publisher and Edition
1	Instrumentation	Franklyn Kirk & Nicholas Rimboi	D. B. Taraporevala Sons & Co Private Ltd
2	Industrial control and Instrumentation	W. Bolten	Universities Press (India) Ltd
3	Process control	Coughner	McGraw Hill Publishing Company Ltd
4	Fundamentals of Industrial Instrumentation	Barua	Wiley India Pvt. Ltd.

Weblink:

1. https://nptel.ac.in/courses/103105064/

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE, MATUNGA, MUMBAI - 400 019. T & A Chemistry Department

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: MEMBRANE TECHNOLOGY
COURSE CODE	: 175CH56

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
3	-	-	3	3	80	32	20	100	40	-	-	-	-	--	-	100

Course Objective:

1. To know Membrane processes, types of processes
2. To understand working of membrane process, transport mechanism and various applications
3. To understand Preparation of membranes

Course Outcomes:

Student should be able to

CO1	Understand Membranes, types of membrane process, types of waste water
CO2	Know Transport mechanism of membrane process
CO3	Understand Working principle of several membrane based operation
CO4	Explain Preparation of membranes

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Introduction and Application of Membrane Technology**	6	12	1	40%	40%	20%
	1.1	Membrane technology, types of processes, nature of membrane process						
	1.2	What are membranes, types of membranes						
	1.3	types of waste, classification of waste water, Various application of membrane technology Domestic and industrial sector						
2		**Membrane transport kinetics**	8	12	2	40%	40%	20%
	2.1	Introduction						
	2.2	Solution diffusion model						

	2.3	Transport through porous membranes (Hagen poiseullie equation and kozeny Carmen equation)						
	2.4	Concentration polarization concept, effect of concentration polarization of membrane transport, resistance in series model						
3		**Reverse osmosis and Nano-filtration**	**10**	**16**	**3**	40%	40%	20%
	3.1	History and introduction of a RO and NF process, working principle						
	3.2	Membrane and membrane materials for RO and NF processes, membrane categories, membrane modules						
	3.3	Membrane fouling and cleaning, applications						
SECTION-II								
4		**Ultrafiltration and microfiltration process**	**10**	**16**	**3**	**40%**	**40%**	**20%**
	4.1	History and introduction of MF and UF processes, working of process, design parameters of process						
	4.2	Membrane types and materials, membrane modules, fouling and cleaning						
	4.3	System types and applications (paint, food and waste treatment)						
5		**Miscellaneous membrane operations**	**06**	**10**	**3**	**40%**	**40%**	**20%**
	5.1	Osmosis, elctro-dialysis, pervaporation, gas separation						
	5.2	membrane distillation, ion exchange membane						
6		**Preparation of membranes**	**08**	**14**	**4**	**40%**	**40%**	**20%**
	6.1	Preparation of polymeric membranes, Phase inversion process, solvent selection, process parameters for phase inversion processes						
	6.2	Preparation of Inorganic membranes, Sol gel method						
		Total	**48**	**80**				

Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

Reference books:

Sr. No.	Author	Title	Publisher and Edition
1	Mulder M.	Basic principles of Membrane Technology	Kluwer Academic Publications
2	Baker R. W.	Membrane Technology and Applications	Wiley Publications

Weblinks:

1. https://nptel.ac.in/courses/116104045/6
2. https://nptel.ac.in/courses/103105060/8

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE, MATUNGA, MUMBAI - 400 019. T & A Chemistry Department

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: RENEWABLE ENERGY TECHNOLOGIES
COURSE CODE	: 175CH56

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
3	-	-	3	3	80	32	20	100	40	-	-	-	-	-	-	100

Course Objective:

1. To understand the importance of renewable energy and its utilization
2. To understand the environmental aspects of these resources

Course Outcomes:

Student should be able to

CO1	Understand and analyze the pattern of renewable energy resources
CO2	Describe the concept of new energy sources.
CO3	Know the environmental aspects of wind energy.
CO4	Explain the importance of renewable energy and its utilization for fuel production.

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Solar Energy**	**10**	**16**	**1**	**40%**	**40%**	**20%**
	1.1	Solar Radiation, Measurements of solar Radiation and sunshine ,						
	1.2	Solar Thermal Collectors, Flat Plate and Concentrating Collectors, Solar Applications,						
	1.3	Fundamentals of photo Voltaic, Conversion, solar Cells, PV Systems, PV Applications.						
2		**Tidal, Geothermal and Hydel energy**	**10**	**12**	**1**	**40%**	**40%**	**20%**
	2.1	Tidal energy ,Wave energy , Data, Technology options,						
	2.2	Open and closed OTEC Cycles, Small hydro, turbines,						
	2.3	Geothermal energy sources, power plant and environmental issues						

3		**New Energy Sources**	**8**	**12**	**2**	**40%**	**40%**	**20%**
	3.1	Hydrogen, generation, storage, transport and utilization, Applications : power generation, transport,						
	3.2	Fuel cells, technologies, types, economics and the power generation.						
SECTION-II								
4		**Wind Energy**	**10**	**20**	**3**	**40%**	**40%**	**20%**
	4.1	Wind Data and Energy Estimation, wind Energy Conversion Systems,						
	4.2	Wind Energy generators and its performance, Wind Energy Storage, Applications, Hybrid systems.						
5		**Bio - Energy**	**10**	**20**	**4**	**40%**	**40%**	**20%**
	5.1	Biomass, Biogas, Source, Composition, Technology for utilization ,						
	5.2	Biomass direct combustion, Biomass gasifier, Biogas plant, Digesters,						
	5.3	Ethanol production, Biodiesel production and economics.						
		Total	**48**	**80**				

Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

Text books:-

Sr. No.	Author	Title	Publisher and Edition
1	Non Conventional Energy Sources,	G.D. Rai	Khanna Publishers,New Delhi, 1999.
2	Solar Energy	S.P. Sukhatme	Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997

Reference books :-

Sr. No.	Author	Title	Publisher and Edition
1	Wind Energy Conversion systems	L.L. Freris	Prentice Hall, UK, 1990.

Weblink:

1. https://nptel.ac.in/courses/112104225/22

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: INDUSTRIAL MANAGEMENT (FINANACE ASPECT)
COURSE CODE	: 175CH56

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME												
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
3	-	-	3	3	80	32	20	100	40	-	-	-	-	-	-	100

Course Objective:

1. To understand basic principles of management.
2. To apply management techniques in the industrial organization.

Course Outcomes:

Student should be able to

CO1	Understand process of Industrial finance and its management.
CO2	Know the management aspects of the organizations.
CO3	Describe the latest trends in industrial management.
CO4	Understand the organizations and its ownership concept.

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Introduction to Industry**	**12**	**16**	**4**	**40%**	**40%**	**20%**
	1.1	Meaning – Definition						
	1.2	Types of Industry						
	1.3	Engineering industry						
	1.4	Process industry						
	1.5	Textile industry						
	1.6	Chemical industry						
	1.7	Agro industry						
	1.8	IT industry						
	1.9	Banking, Insurance, Retail, Hospitality, Health Care						
	1.10	Types of Ownership of Industry: Proprietorship; Partnership; Private Ltd Company;						
	1.11	Public Ltd Company; Co-operative Enterprises; Public Sector Enterprises						

2		**Management**	6	12	2	40%	40%	20%
	2.1	Introduction to management						
	2.2	Principles of management.						
	2.3	Meaning, definition and importance.						
	2.4	Relevance of management to engineers.						
	2.5	Resources of management						
3		**Supervisor & Supervision**	6	12	2	40%	40%	20%
	3.1	Meaning and defination						
	3.2	Role and Responsibilities of supervisor						
	3.3	Qualities of Supervisor						
	3.4	Skills of Supervisor						
	3.5	Functions of Supervisor						
		SECTION-II						
4		**Quality Management**	6	14	3	40%	40%	20%
	4.1	Meaning of Quality Quality Management System - Activities, , ,.2 7.						
	4.2	Benefits Quality Control - Objectives, Functions, Advantages Quality Circle - Concept						
	4.3	Characteristics & Objectives Quality Assurance System Concept						
	4.4	Meaning of Total Quality and TQM Components of TQM - Concept,						
	4.5	Elements of TQM, Benefits						
	4.6	Modern Technique & Systems of Quality Management like Kaizen,5'S',6 Sigma 7.4 ISO 9001:2000 - Benefits, Main clauses						
5		**Financial Management**	8	12	1	40%	40%	20%
	5.1	Capital Generation & Management -						
	5.2	Types of Capitals - Fixed & Working						
	5.3	Sources of raising Capital						
	5.4	Features of Short term, Medium Term & Long Term Sources						
	5.5	Types of Budgets, Fixed & Variable Budget – Concept						
	5.6	Production Budget - Sample format						
	5.7	Labour Budget - Sample format						
	5.8	Profit & Loss Account & Balance Sheet - Meaning, sample format,						
	5.9	Meaning of different terms involved: Excise Tax ; Service Tax; GST						
	5.10	Income Tax; Value Added Tax; Custom Duty						

6		**Cost and cost calculation**	**10**	**14**	**1**	**40%**	**40%**	**20%**
	6.1	Objectives of cost calculation.						
	6.2	Classification of cost						
	6.3	Variable and fixed cost						
	6.4	Direct and indirect cost						
	6.5	Functional cost						
	6.6	Cost control and cost reduction						
	6.7	Overheads and types of overheads						
	6.8	Cost calculation of a product						
	6.9	Break even analysis						
	6.10	Depreciation depreciation calculation.						
		Total	**48**	**80**				

Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

Text books:

Sr. No.	Author	Title	Publisher and Edition
1	O.P. Khanna	Industrial Management	Dhanpat Rai & Sons; 5th Edition, 2012
2	T.R. Banga and S.C. Sharma	Industrial organization and Engineering Economics	Khanna Publication; 10th Edition, 2010

Weblink:

1. https://nptel.ac.in/courses/112107142/
2. https://nptel.ac.in/courses/112107143/

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE, MATUNGA, MUMBAI - 400 019. T & A Chemistry Department

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: NUMERICAL METHODS IN CHEMICAL ENGINEERING
COURSE CODE	: 175CH56

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
3	-	-	3	3	80	32	20	100	40	-	-	-	-	-	-	100

Course Objective:

1. To use features of SCILAB
2. To solve linear equations and ODE'S
3. To learn mathematical modelling of chemical processes

Course Outcomes:

Student should be able to

CO1	Use SCILAB software for data analysis and validation
CO2	Find approximate root of algebraic equations using bisection and newton-raphson method, solving of linear equations using Guassian elimination method
CO3	Perform numerical integration using simson's and trapezoidal rule
CO4	Solve Ordinary differential equations

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Introduction to Scilab software**	6	10	1	40%	40%	20%
	1.1	Explain use and features of Scilab						
	1.2	Solving of simple problems in scilab						
2		**Numerical solution of systems of linear equations**	8	12	2	40%	40%	20%
	2.1	Gussian elimination method, concept and methods of solving problems related to chemical engineering						
	2.2	Matrix Inversion						
3		**Numerical Integretion**	**10**	**18**	**3**	40%	40%	20%
	3.1	Tapezoidal Rule						
	3.2	Simson's 1/3 rule						
	3.3	Simson's 3/8 rule						

SECTION-II								
4		**Numerical Solution of Algebraic Equations**	12	20	3	40%	40%	20%
	4.1	Bi-section method, concept and methods						
	4.2	Newton-Raphson Method						
	4.3	RegulaFalsi Method						
5		Numerical Methods to solve ODE's	12	20	3	40%	40%	20%
	5.1	Eulars Method						
	5.2	Runge-Kutta method						
		Total	**48**	**80**				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).								

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

Text books:

Sr. No.	Author	Title	Publisher and Edition
1	Grewal B. S.	Numerical Methods in Engineering & Science	Khanna Publications
2	Jain M. K., Iyengar S.R.K., Jain R.K.	Numerical Methods For Scientific And Engineering Computation	John Wiley & Sons

Reference books:

Sr. No.	Author	Title	Publisher and Edition
1	Chapra S. C., Canale R. P.,	Numerical Methods for Engineers	McGraw-Hill Education
2	Dorfman K. D., Daoutidis P	Numerical Methods with Chemical Engineering Applications	Cambridge University Press

Weblinks:

- https://nptel.ac.in/courses/122102009/
- https://nptel.ac.in/courses/111105038/
- www.scilab.org

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

VJTI, MATUNGA, MUMBAI - 400 019. T & A Chemistry Department

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: FERTILIZER TECHNOLOGY
COURSE CODE	: 175CH56

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
3	-	-	3	3	80	32	20	100	40	-	-			00	00	100

Rational: India is a agriculture country It is therefore vital for chemical engineers to understand for each fertilizer product, its flow diagram for Industry production processes.

Course Objectives:

1. To make students aware of crop needs, soil deficiencies.
2. Fortification of soil through selected fertiliser or mixer of fertilisers
3. Introduce students to bio-fertilizers and their advantages.

Course Outcomes:

Student should be able to

CO1	Classify fertilizers on the basis of different properties
CO2	Use reactions and unit operations steps for manufacturing of various fertilizers
CO3	Recommend fertilizer based on soil analysis.
CO4	Justify use of bio fertilizers.

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Introduction to Fertilizers**	06	10	1	40%	40%	20%
	1.1	Synthetic fertilizers, Classification of fertilizers Role of essential Elements in plant Growth, Macro elements and Micro elements						
	1.2	Application of fertilizers considering Nutrient Balance and types of crop						
2		**Manufacturing of Ammonia**	06	10	2	40%	40%	20%
2	2.1	Synthesis of Ammonia gas by Catalytic partial oxidation Steam Hydrocarbon reforming						
	2.2	Ammonia converters: Single bed and multi-bed converter						
	2.3	Manufacturing of ammonia by Linde Ammonia concept process M. W. Kellogg process and Haldor Topsoe process						
	2.4	Storage and Transportation of Ammonia						
3		**Manufacturing of Nitric Acid**	06	10	2	40%	40%	20%
	3.1	Manufacturing of Nitric Acid by Pressure ammonia oxidation process and Intermediate pressure ammonia oxidation process						

	3.2	Concentration of Nitric acid by Mg(NO3)2						
4		**Manufacturing of Urea**	06	10	2	40%	40%	20%
	4.1	Physical, chemical properties						
	4.2	Manufacturing of Urea by Stamicarbon's CO2 stripping process Montecatini Solution recycle process						
	4.3	Toyo-Koatsu total recycle process						
SECTION II								
5		**Manufacturing of Ammonium nitrate**	06	10	3	40%	40%	20%
	5.1	Manufacturing of Ammonium nitrate by Prilling process, carbonate and gypsum						
	5.2	Ammonium chloride from Ammonium sulphate and sodium chloride						
6		**Manufacturing of elemental phosphorous**	06	10	3	40%	40%	20%
	6.1	Manufacturing of elemental phosphorous by Electric furnace method						
	6.2	Manufacturing phosphoric acid by Wet Process						
	6.3	Strong Sulphuric Acid Leaching Hydrochloric Acid Leaching Electric Furnace Process						
7		**Manufacturing of Phosphates**	06	10	3	40%	40%	20%
	7.1	Manufacturing of NPK, Ammonium Sulphate						
	7.2	Manufacturing of Ammonium Sulphate Phosphate (ASP), Calcium Ammonium Nitrate(CAN)						
8		**Biofertilizers**	06	10	3	40%	40%	20%
	8.1	Types of Biofertilizers, Nitrogen-fixing biofertilizers						
	8.2	Phosphate-solubilizing biofertilizers						
	8.3	Preparation of a biofertilizers						
		Total	**48**	**80**				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).								

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

Reference books:

Sr. No.	Author	Title	Publisher and Edition
1	M. Gopala Rao Sitting Marshall	Dryden's Outlines of Chemical Technology,	Affiliated East West Press (Pvt) Ltd, 3rd Ed., New Delhi
2	Austin G.T.	Shreve's Chemical Process Industries, 5th edition	McGraw Hill publication, New Delhi
3	N. S. Subba Rao	Biofertilizers in Agriculture,	Oxford & IBH Publishing Company, New Delhi

Curriculum Coordinator **Head** **Dean – Diploma**

Diploma in CHEMICAL ENGINEERING

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: BIOCHEMICAL TECHNOLOGY
COURSE CODE	: 175CH56

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME											
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
3	-	-	3	3	80	32	20	100	40	-	-	-	-	-	-	100

Course Objective:

1. To understand basic principles of management.
2. To apply management techniques in the industrial organization.

Course Outcomes:

Student should be able to

CO1	Calculate microbial/enzymatic kinetics parameters and Design enzyme reactors and scale up fermenters.
CO2	Calculate biomass production/substrate requirements and decide process parameters
CO3	Estimate energy equipments/oxygen requirements
CO4	Estimate bio-reactor size/time for a given microbial/enzymatic process.

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Introduction to Biotechnology and enzyme**	14	25	1	40%	40%	20%
	1.1	Role of chemical engineers in biotechnology						
	1.2	Basics of Genetic Engineering and Tissue Culture : Recombinant DNA technology						
	1.3	Structure function relations of enzymes; Classification						
	1.4	Mechanism of Enzyme action, Enzyme kinetics, inhibition and regulation Enzyme purification and characterization, Coenzymes, cofactors						
2		Bioprocess Development	10	15	2	40%	40%	20%
	2.1	Plant and animal cell cultures for the production of biochemicals, Enzyme reactors, thermostabilization, Immobilized cells						
	2.2	Kinetics of microbial growth, models and simulations, Batch and continuous culture, Mixed microbialculture ,						
SECTION II								
3		**Bio reactor**	14	22	4	40%	40%	20%
	3.1	Integration of downstream processing with bio-processing.						
	3.2	Transport phenomena in bio-reactions and bioreactors.						

	3.3	Reactor design for biochemical reactions and scale up, Process Design for bioproducts, Bioreactor design, Scale up of bioreactions/reactors,						
4		**Fermentation**	**10**	**18**	**3**	**40%**	**40%**	**20%**
	4.1	Fundamentals of fermentation-submerged fermentation,						
	4.2	Fermenter design and basic biochemical engineering aspects of fermentation						
		Total	**48**	**80**				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).								

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

Text books:

Sr. No.	Author	Title	Publisher and Edition
1	D. G. Rao	Introduction to Biochemical Engineering	McGraw Hill Education; 2 edition (1 August 2009)

Curriculum Coordinator

Head
Diploma in CHEMICAL ENGINEERING

Dean – Diploma

T & A Chemistry Department

DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: FIFTH
COURSE TITLE	: PROJECT-I
COURSE CODE	: 175CH57

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION SCHEME												
L	T	P	CR	PAPER HRS	TH		IST	TOTAL		PR		OR		TW		TOTAL MARKS
					Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	
-	-	3	3	-	-	-	-	-	-	-	-	50*	20	50	20	100

Course Objective:

1. To analyse, identify the problems
2. Technical solution, calculation and analysis of technical data
3. Economic feasibility

Course Outcomes:

Student should be able to

CO1	Selection and analysis of problem
CO2	Literature survey
CO3	Generation or gathering of technical data, solution to current problem
CO4	Analysis of data and conclusion

Course Content:

SECTION-I								
Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		**Introduction**	6		1	40%	40%	20%
	1.1	Selection of problem, problem statement						
	1.2	History, need to solve the problem						
2		**Selections of Topics**	10		1	40%	40%	20%
	2.1	Based on real time industrial problems						
3		**Literature Review**	24		2			
	3.1	Gathering and analyzing literature on concern problem						
	3.2	Finding of probable solutions						
4		**Seminar**	8		4	40%	40%	20%
	4.1	Presentation on minor project work						
		Total	48					
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).								

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

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Diploma in CHEMICAL ENGINEERING