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Programme: Diploma in CHEMICAL ENGINEERING (DCHE)

Semester: III

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				
175MA31c	MATHEMATICS III	A	3	2	-	5	3	80	32	20	100	40	-	-	-	-	25	10	125	
175CH32	STOICHIOMETRY	B	3	2	-	5	3	80	32	20	100	40	-	-	-	-	25	10	125	
175ST33	ENGINEERING MECHANICS	A	3	-	2	5	3	80	32	20	100	40	-	-	-	-	25	10	125	
175CH34	MECHANICAL OPERATIONS	C	4	-	3	7	3	80	32	20	100	40	50*	20	-	-	50	20	200	
175CH35	INDUSTRIAL CHEMICAL MANUFACTURING	A	4	-	3	7	3	80	32	20	100	40	50*	20	-	-	50	20	200	
175CH36	PROFESSIONAL PRACTICES (LAB SAFETY)	C	-	2	-	2	-	-	-	-	-	-	-	-	-	-	25	10	25	
	TOTAL		17	6	08	31		400	-	100	500	-	100	-	-	-	200	-	800	

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

* Indicates assessment by External Examiner

Curriculum Coordinator

Head

Dean - Diploma

Diploma in CHEMICAL ENGINEERING (DCHE)



DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: THIRD
COURSE TITLE	: MATHEMATICS III
COURSE CODE	: 175MA31c

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			
3	2	-	5	3	80	32	20	100	40	-	-	-	-	25	10	125

Course Objectives:

1. To make students well versed in various methods of integration for solving problems.
2. To expose students to the techniques of solving differential equations.
3. To impart knowledge of probability, statistics.

Course Outcomes:

Student should be able to

CO1	Apply formulae and different methods of integration in engineering concepts.
CO2	Apply definite integral to find area under curve and volume of solid of revolution.
CO3	Use different methods to solve differential equations.
CO4	Apply basics of statistical techniques to solve the problems.

Course Content:

SECTION-I								
Unit & Sub-Unit	Topics/Sub-topics		Hours	Marks	CO	R Level	U Level	A Level
1	Integration		14	20	1	40%	40%	20%
	1.1	Definition of integration. Integration of standard functions.						
	1.2	Theorems of integration						
	1.3	Methods of Integration						
	1.3.1	Integration by substitution						
	1.3.2	Integration of rational functions.						
	1.3.3	Rules of partial fractions, Integration by partial fractions.						
	1.3.4	Integration by parts.						

2		Definite Integral	10	20	2	30%	30%	40%
	2.1	Definition of definite integral.						
	2.2	Properties of definite integral with simple Problems.						
	2.3	Applications of definite integral						
	2.3.1	Introduction to curves- circle, parabola, ellipse, loop of the curve.						
	2.3.2	Area under curve.						
	2.3.3	Volume of solid of revolution.						
SECTION-II								
3		Differential Equations	12	20	3	30%	30%	40%
	3.1	Order and degree of the differential equation.						
	3.2	Formation of differential equations.						
	3.3	Solution of differential equation of first order, first degree.						
	3.3.1	Variable separable method						
	3.3.2	Reducible to variable separable Method						
	3.3.3	Homogeneous differential equation						
	3.3.4	Exact differential equation.						
	3.3.5	Introduction of integrating factor.						
	3.3.6	Linear differential equation.						
	3.3.7	Bernoulli's differential equation						
4		Statistics	12	20	4	40%	40%	20%
	4.1	Mean, Standard Deviation, Variance, coefficient of variation						
	4.2	Elementary Probability						
	4.2.1	Revision of set theory						
	4.2.2	Sample space, Types of events						
	4.2.3	Definition of probability						
	4.2.4	Conditional probability						
	4.2.5	Independent events						
	4.2.6	Multiplication theorem						
	4.2.7	Addition theorem.						
		Total	48	80				

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

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	Integration	1	1
2	1	Integration by substitution method	1	1
3	1	Integration by partial fractions.	1	1
4	1	Integration by parts.	1	1
5	2	Definite integral.	1	2
6	2	Applications of definite integrals	1	2
7	3	Order, degree and formation of the differential equation.	1	3

8	3	Solution of differential equation of first order, first degree.	1	3
9	4	Measures of central tendency and dispersion,	1	4
10	4	Probability	1	4

Reference books :

Sr. No.	Author	Title	Publisher and Edition
1	S. P. Deshpande	Mathematics for Polytechnic	Pune Vidyarthi Griha Prakashan.
2	H. K. Dass	Advanced Engineering Mathematics	S. Chand & Company Ltd. Delhi
3	Dr. B. S. Grewal	Higher Engineering Mathematics	Khanna Publishers Delhi
4	S. C .Gupta and Kapoor	Fundamental of Mathematical Statistics	S. Chand Publications



Curriculum Coordinator



Head

Diploma in CHEMICAL ENGINEERING



Dean – Diploma

Sem III, DCHE, VJTI



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DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: THIRD
COURSE TITLE	: STOICHIOMETRY
COURSE CODE	: 175CH32

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			
3	2	-	5	3	80	32	20	100	40	-	-	-	-	25	10	125

Course Objectives:

1. Define different unit systems
2. Explain importance of process calculation. Find out quantity of material input and outputs of various unit operation equipments.
3. Calculate material input and outputs of chemical reactions, to identify excess and limiting components.
4. Calculate the enthalpy associated with a reaction, also to calculate the quantities of utility required.

Course Outcome:

Students should be able to:

CO 1	Conversion of units and dimensions, Calculate the amount (in moles or grams) of a particular substance produced in the operation without occurring chemical reaction.
CO 2	Identify the limiting and excess reagents in a reaction mixture and determine the amount (in moles or grams) of product(s), excess reagent(s) remaining at the end of a reaction.
CO 3	Calculate the theoretical yield, actual yield, and percent yield for a chemical reaction.
CO 4	Solve problems on energy balance calculations

Course Content

SECTION-I										
Unit & Sub-Unit	Topics/Sub-topics				Hours	Marks	CO	R Level	U Level	A Level
1	Dimensions and Units				02	05	1	40%	40%	20%
	1.1	Dimensions and systems of units								
	1.2	Fundamental quantities of units, Derived quantities								
	1.3	Definition and units of force, volume, pressure, work,								
	1.4	Unit conversions in FPS, MKS and SI systems.								

2		Introduction to Basic Chemical Calculations	06	10	2	40%	40%	20%
	2.1	Atomic and Molecular Weight, Mole, Mole % & Weight %						
	2.2	Equivalent weight, specific gravity, ppm Liquid and solution Normality, Molarity and molality						
3		Ideal Gas Law	08	15	1	40%	40%	20%
	3.1	Concept of ideal gas						
	3.2	Derivation of ideal gas law						
	3.3	Definition of STP and NTP						
	3.4	Dalton's law and Amagat's law						
	3.5	Derive relation between mole%, volume% and pressure% of ideal gases						
	3.6	Calculation of average molecular weight, density, mole%, weight% in gas mixture in SI/MKS systems						
4		Material balance without chemical reaction	10	10	1	40%	40%	20%
	4.1	Solving material balance without simultaneous equations						
	4.2	Solving material balance with Simultaneous equations						
	4.3	Problems based on unit operations e.g. Distillation, Absorption, Drying and Crystallization						
	4.4	Partial saturation and Humidity						
SECTION- II								
5		Material balance with chemical reaction	10	20	2, 3	40%	40%	20%
	5.1	Problems based on chemical reaction						
	5.2	Calculation of limiting component, excess component of a reaction						
	5.3	Calculations of conversion, yield and selectivity of a reaction						
	5.4	General problems based on above concept						
	5.5	Tutorial						
6		Energy balance	12	20	4	40%	40%	20%
	6.1	Hess law, First law of thermodynamics						
	6.2	Problems on latent heat and sensible heat						
	6.3	Problems on standard heat of formation, standard heat of combustion standard heat of reaction						
	6.4	Use of specific heat and mean specific heat data for calculation of mixture and adiabatic reaction temperature						
	6.5	Tutorial						
		Total	48	80				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxonomy).								

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

Sr. No.	Unit	Assignments	Approximate hours	CO
1	3	Problems on Ideal Gas Law application.	02	1
2	3	Problems on average molecular weight and density of gas mixture	02	1
3	4	Problems material balance on mixing.	02	1, 2
4	4	Problems on material balance on Distillation	02	1
5	4	Problems on Material Balance on other operation	02	1, 2
6	5	Problems on % excess, % conversion, % yield in a Chemical Reaction	04	2, 3
7	5	Problems on calculating the % composition of product stream on mole basis and weight basis for a Chemical Reaction.	04	2, 3
8	4,5	Problems on calculating the feed input	02	1
9	6	Problems on calculating the Heat of the Reaction.	02	4
10	6	Problems on Heat of Formation.	02	4
11	6	Problems based Heat of Reaction for Cp values.	02	4

Text books:

Sr. No.	Author	Title	Publisher
1	K. A. Ghavane	Stoichiometry	Nirali Publications
2	Bhatt and Thakore	Stoichiometry	Tata McGraw Hill Publication

Reference books:

Sr. No.	Author	Title	Publisher
1	D. H. Himmelblau	Basic principle and calculations in chemical engineering	PHI Publications
2	Hougan and Watson	Chemical Process Principles	Wiley Eastern Publications
3	K. V. Narayanan, B. Laksmikutty	Stoichiometry and Process calculations	PHI Publications



Curriculum Coordinator



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Dean - Diploma

Diploma in CHEMICAL ENGINEERING



DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: THIRD
COURSE TITLE	: ENGINEERING MECHANICS
COURSE CODE	: 175ST33

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			
3	-	2	5	3	80	32	20	100	40	-	-	-	-	25	10	125

Course Objectives:

1. To understand the principles of mechanics and its applications to chemical engineering.
2. To describe static forces on the structures and principles of equilibrium along with theory of simple machines.
3. To develop the desired abilities, skills and attitude to analyze and solve the problems encountered in chemical engineering.

Course Outcomes:

Student should be able to

CO1	Explain the fundamental concepts of Engineering Mechanics, Define important terms and Apply the concepts of resolution, composition and equilibrium of forces to simple structures, analytically and graphically.
CO2	Compute position of centroid and centre of gravity of composites and apply concept of equilibrium to centroid and centre of gravity.
CO3	Explain existence of friction, Define important terms related to friction and solve problems on limiting frictional force, angle of repose etc.
CO4	Explain principles of simple machines, Define important terms related to it and to Draw Graphs for law of machines, maximum efficiency etc.

Course Content:

SECTION I							
Unit & Sub-Unit	Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1	Fundamental concepts	02	04	1	29	42	29
	Statics, Dynamics, Kinematics, Kinetics, Concept of force, its SI unit, system of forces: Co-planar, Non coplanar Concurrent, Non concurrent, Parallel, Nonparallel, Collinear, Noncollinear Like and Unlike. Principle of transmissibility of a force.						

2	Resolution and Composition of forces	12	20	1	17	35	48
	Resolution of a force, concept of a moment of a force, laws of moments and couples, Composition of co-planar, concurrent, non-concurrent, parallel forces, Resultant of a general system of co-planar forces.						
3	Equilibrium	10	16	1	21	33	46
	Definition, Relation between resultant & equilibrant, condition of equilibrium, Types of supports simple and special - conditions, roller, hinge & fixed. Free body diagram, simply supported & over hanging beams						
SECTION II							
4	Center of Gravity and Centroid	8	13	2	20	27	53
	Definitions, Centroid of regular plane areas and their combinations, Center of gravity of simple solids: Cube, Cylinder, Prism, Sphere, Cone and their combinations						
5	Friction	8	14	3	32	32	36.
	Laws of friction, terms used: Co-efficient of friction, angle of friction, repose, equilibrium of bodies on level and inclined planes.						
6	Simple Mechanics	8	13	4	28	32	40
	Definition of terms used: mechanical advantage, velocity ratio, efficiency, friction in the machine, law of machine, conditions of the reversibility, study of simple machines : simple screw jack, axle and wheel, differential axle and wheel, single purchase crab.						
	Total	48	80				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms’s Revised Taxonomy).							

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
		Experiments		
1	1	Law of polygon of forces	2	1
2	2	Reaction of Simply supported Beams.	2	1
3	3	Forces in jib crane.	2	1
4	4	Simple screw jack.	2	4
5	5	Differential axle and wheel	2	4
		Graphic Statics Sheets: Two half-imperial size drawing sheets (or A4 sheets with one problem each) in the graphic static with minimum five problems out of the following:		
6	6.1	Resultant of concurrent forces.	1	1
	6.2	Resultant of parallel forces	2	1
7	7.1	Resultant of non-concurrent, non-parallel forces.	2	1
	7.2	Reactions of a simply supported beam.	2	1
8	8.1	Equilibrium of bodies.	2	1
9	9.1	Centroids of plane composite areas	2	2
	9.2	Center Of gravity Of composite solids	2	2

* Minimum 8 and maximum 12 Practical/Experiment sessions to be included in a course in a term

Text Books:

Sr. No.	Author	Title	Publisher and Edition
1	S. B. Junnarkar,	Applied mechanics	17th edition ,Revised, 2010, Publisher-Charotar Publishing House Pvt. Ltd.
2	R. K. Bansal	Engineering mechanics	3 rd Revised Edition 2015, Laxmi Publications Pvt. Ltd.

Reference books and Websites:

Sr. No.	Author	Title	Publisher and Edition
01	Dadhe, Jamdar and Walawalkar	Fundamentals of Applied Mechanics	Second edition 2006, Publisher-SaritaPrakashan
02	Websites	www.nptel.ac.in	IITs.



Curriculum Coordinator



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Dean – Diploma

Diploma in CHEMICAL ENGINEERING

Sem III, DCHE, VJTI



DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: THIRD
COURSE TITLE	: MECHANICAL OPERATIONS
COURSE CODE	: 175CH34

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			
4	0	3	7	3	80	32	20	100	40	50	20	-	-	50	20	200

Course Objectives:

- To understand various mechanical operations used in Chemical Industries.
- To understand the working principle and construction of various equipments used in the above operations.

Course Outcomes:

Student should be able to

CO 1	Understand the basics of unit operations and principles of various size reduction machines and analyze the solid
CO 2	Explain the concept of methods of separation of solid based on specific properties.
CO 3	Describe the working of various filtration equipment and sedimentation
CO 4	Design the mixing tank and handling of solids.

Course Content:

SECTION-I							
Unit & Sub-Unit	Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1	Introduction to the unit operations of chemical Engineering	05	04	1	40%	40%	20%
	1.1 Basic laws, Ideal gas law, Dalton's law, Amagat's law, etc.						
	1.2 Steady state, Equilibrium state						
	1.3 Dimensions and units, dimensional formulae, dimensional analysis, dimensionless group, useful mathematical methods						
2	Size reduction:	11	14	1	40%	40%	20%
	2.1 Theory and principles involved in crushing and grinding, Crushing efficiency.						
	2.2 Classification and Types of crushing and grinding, Principles of their working, Rittingers Law, Kick's law, Bond's law, and work index.						
	2.3 Study of different equipment used in size reduction						

		operations such as Jaw crusher, Ball mill, hammer mill, crushing roll, Gyratory crusher, fluid energy mill, Various comparisons, Derivation of critical speed of ball mill						
	2.4	Problems based on above operations.						
3		Methods of separation of solids	09	12	2	40%	40%	20%
	3.1	Particle size measurement, Screen analysis, Screen effectiveness, Ideal screen, Actual screen.						
	3.2	Study of different equipment used in grading such as Grizzlies, trommels, vibrating screens etc. Problems based on above operations						
4		Mixing	07	10	4	40%	40%	20%
	4.1	Types of impellers, Study of equipment used for mixing Liquids with liquids, gases with liquids, viscous masses, solids with liquids, solids with solids. eg. Sigma mixer, banbury mixer ,muller mixer, tumbling mixer etc.						
	4.2	Flow patterns in agitated vessel, Significance of baffle.						
	4.3	Study of power consumption of mixer.						
SECTION II								
5		Methods of separation of solid based on specific properties	15	17	2	40%	40%	20%
	5.1	Size separation by settling wet classification, different type of classifier (Non Mechanical, mechanical and hydraulic classifier)						
	5.2	Cyclone separator: - Principle and their working.						
	5.3	Magnetic separation, principle and different types of magnetic separators,						
	5.4	5 Electrostatic separation, types of charging, type of equipment.						
	5.5	Froth flotation, principle application and different types of flotation machines.						
6		Filtration	10	10	3	40%	40%	20%
	6.1	Principle of filtration and factors which affect the rate of filtration.						
	6.2	Types of Filters.						
	6.3	Derivation of rate equation for filtration and various parameters involved in the rate equation.						
	6.4	Constant rate filtration, constant pressure filtration.						
7		Sedimentation	04	07	3	40%	40%	20%
	7.1	Principle, batch sedimentation test						
	7.2	Types of thickeners.						
8		Handling of solids	03	06	4	40%	40%	20%
	8.1	The nature and characteristics of bulk solids.						
	8.2	Study of different type of conveyors						
		Total	64	80				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms’s Revised Taxonomy).								

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.		Practical/Assignment	Approx.	CO
1	3	Screen analysis of sand	3	1
2	3	Effectiveness of given screen	3	1
3	2	Estimation of average size by using Jaw crusher	3	1
4	2	Estimation of average size by using Hammer mill	3	1
5	2	Estimation of average size by using Ball mill	3	1
6	7	Determination of settling rate of sedimentation	3	3
7	5	Estimation of efficiency of froth floatation cell	3	2
8	4	Determination of extent of mixing obtained in sigma mixture	3	4
9	6	Estimation of rate of filtration using vacuum filtration	3	3
10	5	Determination of % of solids in the given slurry by using centrifuge	3	2

Text books:

Sr. No.	Author	Title	Publisher
1	K. A. Ghavane	Mechanical Operations	Nirali Publications
2	Hiramanth and Kulkarni	Unit operations in Chemical Engineering (Mechanical Operations)	Everest Publications

Reference books:

Sr. No.	Author	Title	Publisher and Edition
1	W L Badger	Introduction to Chemical Engineering	Mcgraw Hill International, 3 Ed., 1984
2	Coulson & Richardson	Chemical Engineering Series Volume 2	Butterworth Heinmann, 5 Ed., 2010
3	Brown	Unit Operation	CBS Publication, 7Ed., 2005



Curriculum Coordinator



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Dean – Diploma

Diploma in CHEMICAL ENGINEERING

Sem III, DCHE, VJTI

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DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: THIRD
COURSE TITLE	: INDUSTRIAL CHEMICAL MANUFACTURING
COURSE CODE	: 175CH35

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			
4	0	3	7	3	80	32	20	100	40	50	20			50	20	200

Course Objectives:

1. To understand properties of inorganic compounds.
2. To understand synthetic methods of inorganic compounds.

Course Outcomes:

Student should be able to

CO1	Understand different types of flow sheets used in process industry.
CO2	Demonstrate knowledge of various materials used in chemical processes, their properties and specifications in manufacturing of chemical compound.
CO3	Know manufacturing process of typical chemicals.
CO4	Demonstrate safe and proper use of chemicals, glass wares and equipments through laboratory experiments.

Course Content:

SECTION-I							
Unit & Sub-Unit	Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1	Unit Operations and Processes used in Chemical Industries.	10	10	1	40%	40%	20%
	1.1 Introduction to industrial chemistry, various chemical industries, chemical products and raw materials, chemical process.						
	1.2 Concepts and brief description of the unit operations and unit processes used in chemical process, flow diagrams: block diagrams and flow sheets.						
	1.3 Physico-chemical principles: chemical equilibrium and application of Le Chateliers principle.						

2		Inorganic acids Industry	10	20	3	40%	40%	20%
	2.1	Sulphuric acid: Manufacturing processes, physical & chemical properties & uses of Sulphuric acid.						
	2.2	Nitric acid: Manufacturing processes, physical & chemical properties & uses of nitric acid.						
	2.3	Hydrochloric acid: Manufacturing processes, physical & chemical properties & uses of hydrochloric acid.						
	2.4	Phosphoric acid: Manufacturing processes, physical & chemical properties & uses of Phosphoric acid.						
3		Cement Industry	12	10	2	40%	40%	20%
	3.1	Introduction, types of cements, Chemical composition and raw materials of Portland cement,						
	3.2	dry and wet process, Burning, grinding, Packing, setting and hardening of Portland cement, testing of cement						
SECTION-II								
4		Chemistry of Nitrogen and phosphorus Compound	12	20	3	40%	40%	20%
	4.1	Ammonia: Manufacturing of ammonia by Haber's process, physical & chemical properties and uses.						
	4.2	Urea: Manufacturing processes, physical & chemical properties & uses of urea.						
	4.3	Ammonium Nitrate: Manufacturing processes, physical & chemical properties & uses of Ammonium Nitrate.						
	4.4	Ammonium Phosphate: Manufacturing processes, physical & chemical properties & uses of Ammonium Phosphate.						
	4.5	Super phosphate: Manufacturing processes, physical & chemical properties & uses of single super phosphate and triple super phosphate.						
5		Chlor-alkali industry	10	10	2	40%	40%	20%
	5.1	Chlorine: Manufacturing processes, physical & chemical properties & uses of Chlorine.						
	5.2	Caustic soda: Manufacturing processes, physical & chemical properties & uses of Caustic soda.						
	5.3	Soda ash: Manufacturing processes, physical & chemical properties & uses of soda ash.						
6		Industrial fuel gases	10	10	3	40%	40%	20%
	6.1	Oxygen and nitrogen: Manufacturing processes, properties & uses of oxygen and nitrogen.						
	6.2	Hydrogen: Manufacturing processes, properties & uses of Hydrogen						
	6.3	Carbon dioxide: Manufacturing processes, properties & uses of carbon dioxide						
		Total	64	80				
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxonomy).								

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	Analysis of commercial sulphuric acid.	2	3, 4
2	2	Analysis of commercial hydrochloric acid.	2	3, 4
3	2	Analysis of commercial nitric acid.	2	3, 4
4	2	Analysis of commercial phosphoric acid.	2	3, 4
5	5	Analysis of caustic soda.	2	2, 4
6	5	Analysis of soda ash.	2	2, 4
7	5	Analysis of bleaching powder.	2	2, 4
8	3	Analysis of cement.	2	2, 4
9	4	Analysis of fertilizer.	2	3, 4
10	4	Analysis of fertilizer.	2	3, 4

* 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	D. B. Dhone	Chemical Processes Technology I	Nirali Prakashan, Pune, 2 nd edition, 1983
2	G. N. Pandey	Textbook of Chemical Technology - Vol. 2	Schand, New Delhi, 2 nd Edition, 2000

Reference books and Websites:

Sr. No.	Author	Title	Publisher and Edition
1	M. Gopala Rao Marshall Sittig	Dryden's Outlines of Chemical Technology	East West Publishers, New Delhi, 3 rd edition, 2003
2	George T. Austin	Shreve's Chemical Process Industries	Tata Mc Graw Hill, 5 th edition, 1984
3	Davis, K. H	Handbook of Industrial Chemistry VOL. II	C.B.S Publication, New Delhi, 2004


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Diploma in CHEMICAL ENGINEERING

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DIPLOMA PROGRAMME	: DIPLOMA IN CHEMICAL ENGINEERING
PROGRAMME CODE	: DCHE
SEMESTER	: THIRD
COURSE TITLE	: PROFESSIONAL PRACTICES (LAB SAFETY)
COURSE CODE	: 175CH36

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			
-	2	-	2											25	10	25

Course Objective:

1. Understand the basic safety procedures used in a chemical laboratory.
2. Demonstrate awareness of the hazards associated with the chemistry department by properly handling and caring for chemistry equipment, glassware and reagents.
3. Identify the proper disposal of various wastes generated in the chemical lab.

Course Outcomes:

Student should be able to

CO1	Understand the basic safety measures/precautions to be followed while working in laboratory
CO2	Know MSDS sheets
CO3	Understand procurement of chemicals, labeling, handling, storing and transportation of chemicals
CO4	Demonstrate fire safety and emergency measures for chemical hazards

Course Content:

SECTION-I							
Unit & Sub-Unit	Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1	Basic laboratory safety practices	4		1	40%	40%	20%
	1.1 Working Alone						
	1.2 Prevent Chemical Exposure						
	1.3 Washing Hands						
	1.4 Food and Drink						
	1.5 Glassware/Utensils						
	1.6 Storage of Food/Beverages						
	1.7 Vacuum						
	1.8 Access to Emergency Exits and Equipment						
	1.9 Laboratory Signs						
	1.10 House-keeping						

	1.11	Chemical Exchange						
2		Chemical inventory and MSDS/SDS	2		2	40%	40%	20%
	2.1	Access to My Chemical						
	2.2	Conducting your Chemical Inventory						
	2.3	Safety Data Sheet/Material Safety Data Sheet (SDS/MSDS)						
3		Chemical procurement	2		3	40%	40%	20%
	3.1	Hazardous Chemicals						
	3.2	Pharmaceuticals						
	3.3	DEA Controlled Substances						
	3.4	Non-Denatured Ethyl Alcohol						
	3.5	Radioactive Materials						
	3.6	Highly Dangerous Materials						
	3.7	Compressed Gas Cylinder Procure						
4		Chemical storage	4		3	40%	40%	20%
	4.1	Evaluate Chemical Hazards for Storage						
	4.2	Flammability						
	4.3	Reactivity						
	4.4	Corrosivity						
	4.5	Toxicity						
	4.6	Chemical Storage Practices						
	4.7	Chemical Storage Quantity Limits						
	4.8	Control Zones						
	4.9	Flammable Liquids in Basements						
5		Theory of fire	2		4	40%	40%	20%
	5.1	Types of fires						
	5.2	Fire extinguishers						
SECTION-II								
6		Chemical labeling	2		3	40%	40%	20%
	6.1	Original Container, Pictograms						
	6.2	Labeling Stock/Working Solutions						
	6.3	Labeling Specialized Containers						
	6.4	Additional Label Required for Peroxide-Forming Chemicals						
	6.5	Additional Label Required for CFATS Chemicals						
	6.6	Labeling Waste Containers						
7		Transporting chemicals	4		3	40%	40%	20%

	7.1	Transporting between Floors and Buildings on Campus					
	7.2	Moving a Single Chemical					
	7.3	Moving Multiple Chemicals					
	7.4	Transporting Chemicals off Campus					
	7.5	Vehicle Use					
	7.6	Shipment by Others					
	7.7	Training					
	7.8	Laboratory Moves					
8		Special chemical hazards	4	4	40%	40%	20%
	8.1	Reactive Chemicals					
	8.2	Compounds That Generate Toxic Gases					
	8.3	Oxidizers					
	8.4	Chemicals That May Polymerize					
	8.5	Pyrophoric Chemicals					
	8.6	Water Reactive Chemicals					
	8.7	Potentially Explosive Chemicals					
	8.8	Nitrated Compounds					
	8.9	Organic Peroxide-Forming Solvents					
	8.10	Azides					
	8.11	Fulminates					
	8.12	Highly Toxic Substances					
	8.13	Precautions for Use					
	8.14	Categories of Highly Toxic Chemicals					
	8.15	Carcinogens and Reproductive Hazards					
	8.16	Hazardous Drugs					
	8.17	Sensitizing or Allergenic Chemicals					
	8.18	Synthesized Chemicals					
	8.19	Nanoparticles					
	8.20	Providing Synthesized Chemicals to Others					
	8.21	Compressed Gases, Gas Cylinders and Liquid Cryogen Containers					
	8.22	Hazards of Compressed Gases					
	8.23	Safe Practices					
	8.24	Moving Compressed Gas Cylinders					
	8.25	Leaking Gas Cylinders					
	8.26	Compressed Gas Piping and Tubing					
	8.27	Flammable and Combustible Liquids					

9		Chemical Management	4		4	40%	40%	20%
	9.1	Laboratory Safety Manual						
	9.2	Vapor Control						
	9.3	Ignition Source Control						
	9.4	Grounding Concerns						
	9.5	Homeland Security Chemicals of Interest						
	9.6	Do Not Ship List						
	9.7	Do Not Ship Labels						
	9.8	Disposing of Chemicals on the Do Not Ship List						
	9.9	Process Safety for Highly Hazardous Chemicals						
10		Chemical Storage Recommendations	4		3	40%	40%	20%
	10.1	Approved Flammable Liquid Storage Containers						
	10.2	Toxic Gas Generators						
	10.3	Oxidizers						
	10.4	Chemicals that May Polymerize						
	10.5	Pyrophoric Chemicals						
	10.6	Water Reactive Chemicals						
	10.7	Nitrated Compounds						
	10.8	Peroxide-Forming Chemicals						
	10.9	Sensitizing or Allergenic Chemicals						
	10.10	Flash Points and Flammability Limits of Some Chemicals						
	10.11	Reportable if Shipped Chemical List						
		Total	32					

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

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	Robert H. Hill, David C. Finster	Laboratory Safety for Chemistry Students	Wiley International
2	George T. Austin	CRC Handbook of Laboratory Safety	CRC Press



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