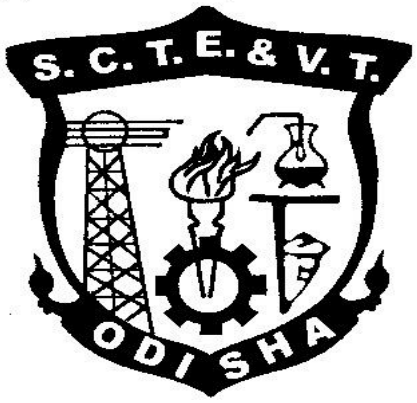
CURRICULLUM OF 3RD SEMESTER

For

DIPLOMA IN CHEMICAL ENGINEERING

(Effective FROM 2019-20 Sessions)



STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

1. SALIENT FEATURES OF THE DIPLOMA PROGRAM IN CHEMICAL ENGINEERING

1.	Name of the Program	:	Diploma Program in Chemical Engineering
2.	Duration of the Program	:	Three Years
3.	Entry Qualifications	:	Matriculation or equivalent as prescribed by AICTE
4	Pattern of the Program	:	Semester Pattern

JOB OPPORTUNITIES

Employment opportunities for diploma holder in Chemical Engineering are visualized in following industries at various levels/positions:

(i) Chemical and Allied Industries like

(a) Fertilizer industry
(b) Petroleum refinery and petrochemical industry
(c) Oil and natural gas corporation
(d) Steel plant
(e) Cement plant
(f) Cosmetic industry
(g) Sugar industry
(h) Mineral industry
(i) Pulp and Paper industry
(j) Food Processing industry
(k) Consumer goods industry etc.
(l) Polymer industry
(m) Food industry
(n) Agro industry
(o) Leather industry
(p) Pharmaceutical industry
(q) Distilleries
(r) Paint and dye industry
(s) Rubber industry
(t) Soap & detergent industry
(u) Textile industry etc.

In various functional areas like erection and commissioning of plant, plant operation, production, maintenance and safety, quality control, inspection and testing, marketing and sales, consultancy services and areas concerning environmental protection.

(i) Research Organizations like CSIR laboratories, Defence laboratories, Atomic energy establishments etc.

(ii) Entrepreneurs to small/tiny units especially food, agro and chemical industries.

3. COURSE OBJECTIVES

Keeping in view the employment opportunities of diploma holders in Chemical Engineering, the course is aimed at developing following knowledge and skills in the students:

1. Basic understanding of concepts and principles related to applied sciences as a foundation for further studies.
2. Development of communication and interpersonal skills for effective functioning in the world of work.
3. Understanding of basic concepts and principles of mechanical, electrical and civil engineering so as to enable the students to apply the knowledge of these principles to the field of chemical engineering.
4. Ability to read and interpret drawings related to plant layout, process equipment and components.
5. Knowledge of various materials used in chemical processes, their properties and specifications.
6. Knowledge and associated skills of various unit operations, unit processes and process instrumentation in process industry.
7. Ability to calculate the quantity of raw materials, energy inputs, manpower requirement and output from the process.
8. Ability to control the process and quality of the products commiserating with laid specifications.
9. Understanding of basic principles of managing men, material and machines/ equipment for optimum production.
10. Appreciation of the need of clean environment and its deterioration by various emissions from industry and preventive procedures and knowledge of safety regulations in process industry.
11. Development of generic skills of thinking and problem-solving, communication, attitudes and value system for effective functioning in a process industry.
12. Proficiency in the use of computers.
13. Basic manual and machining skills as an aid to function effectively in the process industry.
14. Knowledge of testing and quality control activities.
15. Detailed knowledge of petroleum and petroleum products along with processes involved in their production.
16. Detailed knowledge of fertilizers and technology involved in their production along with important fertilizer plants in India.
17. Development of good personality in order to have effective communication and business ethics.

4. DERIVING CURRICULUM AREAS FROM COURSE OBJECTIVES

The following curriculum areas have been derived from course objectives.

Sr. No.	Curriculum Objectives	Curriculum Areas/Subjects
1.	Basic understanding of concepts and principles related to applied sciences as a foundation for further studies.	- Applied Physics - Applied Chemistry - Applied Mathematics
2.	Development of communication and interpersonal skills for effective functioning in the world of work.	- Communication Skills
3.	Understanding of basic concepts and principles of mechanical, electrical and civil engineering so as to enable the students to apply the knowledge of these principles to the field of chemical engineering.	- General Engineering
4.	Ability to read and interpret drawings related to plant layout, process equipment and components.	- Engineering Drawing - Process Equipment Design & Drawing
5.	Knowledge of various materials used in chemical processes, their properties and specifications.	- Chemical Process Industries - Engineering Materials - Applied Chemistry
6.	Knowledge and associated skills of various unit operations, unit processes and process instrumentation in process industry.	- Introduction to Chemical Engineering - Fluid Flow - Heat Transfer - Mechanical Operations - Mass Transfer - Process Instrumentation - Engineering Thermodynamics - Process Utilities - Reaction Engineering
7.	Ability to calculate the quantity of raw materials, energy inputs, manpower requirement and output from the process.	- Industrial Chemical Calculations - Introduction to Chemical Engineering
8.	Ability to control the process and quality of the products commiserating with laid specifications.	- Elective/Specializations - Chemical Process Industries - Process Instrumentation - Engineering, Materials - Engineering Thermodynamics - Reaction Engineering
9.	Understanding of basic principles of managing men, material and machines/ equipment for optimum production.	- Entrepreneurship Development and Management
10.	Appreciation of the need of clean environment and its deterioration by various emissions from industry and preventive procedures and knowledge of safety regulations in process industry.	- Environmental Engineering and Safety
11.	Development of generic skills of thinking and problem-solving, communication, attitudes and value system for effective functioning in a process industry.	- Industrial Visits - Project Work - Process Equipment Design

		and Drawing
12.	Proficiency in the use of computers.	- Computer Applications in Chemical Engineering - Basics of Information Technology
13.	Basic manual and machining skills as an aid to function effectively in the process industry.	- General Workshop Practice
14.	Knowledge of testing and quality control activities.	- Chemical Process Industries
15.	Detailed knowledge of petroleum and petroleum products along with processes involved in their production.	- Petrochemicals
16.	Detailed knowledge of fertilizers and technology involved in their production along with important fertilizer plants in India.	- Fertilizer Technology
17.	Development of good personality in order to have effective communication and business ethics.	- Student Centered activity

5. ABSTRACT OF CURRICULUM AREAS/SUBJECTS

(a) Basic Sciences and Humanities

1. Communication Skills
2. Basics of Information Technology
3. Entrepreneurship Development and Management

(b) Applied Sciences

4. Applied Mathematics
5. Applied Physics
6. Applied Chemistry

(c) Basic Courses in Engineering/Technology

7. Engineering Drawing
8. General Workshop Practice
9. General Engineering

(d) Applied Courses in Engineering/Technology

10. Introduction to Chemical Engineering
11. Engineering Materials
10. Fluid Flow
11. Mechanical Operations
12. Engineering Thermodynamics
13. Reaction Engineering
14. Industrial Chemical Calculations
15. Heat Transfer
16. Mass Transfer
17. Environmental Engineering and Safety Management
18. Process Instrumentation
19. Chemical Process Industries
20. Process Equipment Design and Drawing
21. Computer Applications in Chemical Engineering
22. Petrochemicals
23. Fertilizer Technology
24. Process utilities
25. Major Project

(e) Specialized Courses in Engineering/Technology)
(Electives-I, any one of the following)

26. Petrochemical Industries
27. Biotechnology and Bioprocess Engineering

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 3rd Semester (CHEMICAL)(wef 2019-20)

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Physical Chemistry(C)	4	-	-	20	80	3	100
Th.2		Fluid Mechanics	4	-	-	20	80	3	100
Th.3		Mechanical Operation	4	-	-	20	80	3	100
Th.4		Industrial Stoichiometry	3	1	-	20	80	3	100
Th.5		Environmental studies(C)	4	-	-	20	80	3	100
		Total	19	1	-	100	400	-	500
		Practical							
Pr.1		Physical Chemistry Lab(c)	-	-	4	25	25	3	50
Pr.2		Fluid Mechanics Lab	-	-	3	25	25	3	50
Pr.3		Mechanical Operation Lab	-	-	3	25	25	3	50
Pr.4		Environmental Engineering lab(C)			3	25	-	-	25
Pr.5		Chemical Engineering Drawing	-	-	4	25	50	3	75
		Student Centred Activities(SCA)	-	-	3	-	-	-	-
		Total	-	-	*19*	*125*	*125*	-	*250*
		Grand Total	**19**	**1**	**19**	**225**	**525**	**-**	**750**

Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.

There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester

Th1. PHYSICAL CHEMISTRY

(Common to Chemical, Biotechnology & Food Technology)

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

A. Rationale:

The phenomenal progress of technology in the 20th century has brought dramatic changes in human life styles. The technology, which has thus enhanced the quality of human life, is evolved based on scientific research, primarily physical, inorganic and organic Chemistry. Use of various organic and inorganic compounds and their physical phenomenon are very much essential for any process industry. Therefore the knowledge of Chemistry is necessary for the success of Chemical Engineers, Biotechnologists and Food Technologists.

B. Objective:

On completion of study of Physical Chemistry the student will be able to:

1. Conceptualise physical properties of liquid.
2. Understand solution and its properties.
3. Understand the concept of Osmosis and Osmotic Pressure
4. Explain distribution law.
5. Understand the concept of colloids.
6. Understand the concept of Adsorption

C	**Topic wise distribution of periods**	
Sl. No.	**Topics**	**Periods**
1	Physical Properties of Liquids	10
2.	Solutions	12
3.	Osmosis and Osmotic Pressure	12
4.	Distribution Law	08
5.	The Colloids	10
6.	Adsorption	08
	Total	**60**

D. COURSE CONTENT:

1.0 PHYSICAL PROPERTIES OF LIQUIDS

1.1 Intermolecular forces in liquid.

1.2 Vapour pressure and its effect on temperature and boiling point.

1.3 Surface tension.

1.4 Viscosity and measurement of viscosity by Ostwald method.

1.5 Refractive index, specific refraction, determination of refractive index
1.6 Optical activity and measurement of optical activity.
1.7 Solve simple problems based on physical properties of liquid.

2.0 SOLUTIONS

2.1 Solution and Types of solutions.
2.2 Ways of expressing concentration.
2.3 Solve numerical related to concentration.
2.4 The solution of gases in gases.
2.5 Henry's law and solve numerical related to it.
2.6 Solutions of liquid in liquids.
2.7 Solubility of partially miscible liquids
2.8 Solubility of solid in liquid and equilibrium concept, solubility curve.
2.9 Raoult's Law, ideal solution and explain the lowering of vapour pressure and its measurement.
2.10 Concept of elevation of boiling point and depression of freezing point

3.0 OSMOSIS AND OSMOTIC PRESSURE.

3.1 Osmosis and osmotic pressure with example.
3.2 Function of semi permeable membrane.
3.3 Osmotic pressure and isotonic solutions.
3.4 The theories of Osmosis.
3.5 Reverse osmosis.
3.6 The laws of osmotic pressure.
3.7 Solve the Simple Problems.
3.8 Relation between Vapour Pressure & Osmatic Pressure.

4.0 DISTRIBUTION LAW.

4.1 Nernst's distribution law.
4.2 Equilibrium constant from distribution coefficient.
4.3 Extraction with a solvent, multiple extraction
4.4 Concept of liquid-liquid chromatography.
4.5 Applications of distribution law.
4.6 Numerical based on distribution law.

5.0 COLLOIDS.

5.1 Colloids & types of colloidal systems.
5.2 Characteristics of sols.
5.3 The application of colloids.
5.4 Methods of preparation of sols & purification of sols.
5.5 The optical, kinetic and electrical properties of sols.
5.6 Emulsion and types of emulsion.
5.7 The role of Emulsifier.
5.8 The preparation of Emulsions and their properties.
5.9 Gel, type of gel, properties and application.

6.0 ADSORPTION.

6.1 Adsorption
6.2 Compare absorption and adsorption
6.3 Types of adsorption.
6.4 Physical adsorption and Chemisorption.
6.5 The application of adsorption
6.6 The Ion- exchange adsorption and discuss its application.

Syllabus Coverage up to I.A
Chapter 1,2,3,4

E. Books Recommended :

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	B.S. Bahl, H.D. Tuli, A. Bahl	Essentials of Physical Chemistry	S. Chand & Co
2	K.K. Sharma, L.K. Sharma	A Text Book Of Physical Chemistry	Vikash Publication

Th2. FLUID MECHANICS

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

A. Rationale :

Besides the use of solids, use/application and handling of fluids (e.g. both liquids and gases) is in wide spectrum of engineering practice. Fluid statics, fluid flow phenomena, flow measurement, fluid flow through pipe lines, fluidized bed etc. in an industry is essentially important. There are many units processes particularly in chemical, petrochemical, pharmaceutical, hydro-metallurgical etc. plants in which fluid flow phenomena are of fundamental importance in design consideration. It is therefore, necessary for an engineer planning career in chemical, petrochemical etc. industries to study fluid flow phenomena, selection of the characteristics of different fluid transportation and flow control devices.

B. Objectives : On completion of studies of fluid mechanics the student will be able to

(i) Understand and explain between fluid statics and fluid dynamics
(ii) Solve simple problems on flow measurement, Bernoulli's equation etc.
(iii) Acquaint themselves with various kinds of pumps, blowers & fans
(iv) Understand various fluid properties like density, viscosity and critical velocity, Reynolds number
(v) Acquire problem solving skill and improvisation of the process.

C.	Topic wise distribution of periods	
Sl. No.	**Topics**	**Periods**
1	Fluid statics	12
2.	Fluid flow phenomenon	16
3.	Flow measurements	12
4.	Transportation of fluid	12
5.	Fluidization	08
	Total	**60**

D. CHAPTER – I FLUID STATICS

1.1 Fluid and its classification
1.2 Properties of fluid and its units
1.3 Newton's law of viscosity, Newtonian & Non-Newtonian fluid
1.4 Hydrostatic equilibrium and pressure head
1.5 Fluid pressure measuring devices
1.6 Different types of manometers and its applications
1.7 Derivation of manometric equation
1.8 Equation of continuity

CHAPTER – II FLUID FLOW PHENOMENA

2.1 Types of flow: laminar and turbulent flow, Reynolds's number, critical velocity
2.2 Mechanism of fluid flow in pipes, Reynolds' experiment
2.3 Bernoulli's theorem, pump work (solve simple problems)
2.4 Flow of incompressible fluids in pipe
2.5 Friction factor, roughness and estimate friction loss in pipes & coils, equivalent length
2.6 Fanning's equation (Solve simple problems),
2.7 Friction losses through sudden enlargement and contraction in pipes
2.8 Flow of fluids in non circular conduits.
2.9 Water hammer.

CHAPTER – III FLOW MEASUREMENT

3.1 Working of flow measuring devices, advantages & disadvantages
3.2 Expression for flow measurement through orifice meter, venturi meter & Pitot tube
3.2 Working of Rota meter and its calibration
3.3 Simple problems on flow measurement

CHAPTER – IV PUMPS AND FITTINGS

4.1 Concept of transportation of fluid by pipes and tubes
4.2 Different pipe fittings and its application
4.3 Different types of valves and their applications
4.4 Classification of pumps
4.5 Construction and working of reciprocating and centrifugal pumps
4.6 Performance characteristics of reciprocating and centrifugal pumps.
4.7 Cavitation, Net positive suction head, Air binding & priming of pump
4.8 Centrifugal pump troubles and remedies
4.9 Working of Piston pump, plunger pump, gear pump, diaphragm pump
4.10 Pumping device for gas: blower, compressor and vacuum devices

CHAPTER – V FLUIDIZATION

5.1 Pressure drop in porous medium
5.2 Concept of fluidization and types of fluidization
5.3 Minimum fluidization velocity
5.4 Fluidized bed pressure drop
5.5 Principle of pneumatic conveyance
5.6 Flow through packed bed.

Syllabus Coverage up to I.A

Chapter 1,2,3

E. Books Recommended :

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	Badgero and Banchero	Introduction to Chemical Engineering	TMH Publication
2	W.L.Mc.Cabe & J.M.Smith	Unit Operation of Chemical Engineering	TMH Publication
3	K A Gavane	Unit Operation-1	Nirali Prakashan

Th3. MECHANICAL OPERATION

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

A. Rationale:

Operations related to size reduction, size separation, filtration, mixing, transportation and storage are important in many chemical and hydro-metallurgical industrial practices from the point of view of consequence and process economy. It is therefore, important to study the principles governing the operations named above (known collectively as mechanical operations) the construction & operation of different equipment and selection of equipment for specific purpose from host of different alternatives.

B. Objective:

On completion of study of Mechanical operation, the student will be able to operate the various equipment used for different operations like size reduction, size separation, filtration, mixing, transportation and storage and solve simple problems.

C.	**Topic wise distribution of periods**	
Sl. No.	**Topics**	**Periods**
1	Size reduction	20
2.	Size separation	16
3.	Filtration	08
4.	Mixing	08
5.	Transportation & storage	08
	Total	60

C. COURSE CONTENT

1.0 SIZE REDUCTION

1.1 Objectives of size reduction
1.2 State laws of crushing like Bonds law, Rittinger's law, Kick's law
1.3 Crushing efficiency, Work index and solve simple problems based on these laws
1.3 Classification of size reduction equipment and their construction and operation (Jaw crusher, Gyratory crusher, Smooth roll crusher, Hammer Mill, Ball Mill,
1.4 Closed and open circuit grinding, dry and wet grinding, free and choke grinding

2.0 SIZE SEPARATION

2.1 Objectives of size separation
2.2 Shape and size of irregular particle.
2.3 Different types of screen analysis, ideal screen & actual screen, material balance
2.4 Construction and operation of different types of industrial screens and their effectiveness
2.5 Construction and operation of air filters, air separator, cyclone separator, magnetic and Electromagnetic separation
2.6 Theory of settling like free and hindered settling, Stroke's law, Classification.
2.7 Sedimentation, thickeners, clarifiers, hydraulic classifiers, jigs, classifier riffled table and their use
2.8 Principle & operation of froth floatation and its use.

3.0 FILTRATION

3.1 Types of filtrations, Theory of filtration, types of cakes, cake resistance, pressure drop, filter medium, filter Aids and related derivation
3.2 Classification, constructions and working principles of filtration equipments, Thickeners
3.3 Batch and continuous centrifuges with their construction, operation and uses.
3.4 Flocculation, coagulants and role of coagulant in filtration

4.0 MIXING

4.1 Objectives of mixing
4.2 Various mixing operations like
(i) Mixing of liquid with liquid
(ii) Mixing of liquid with solid
(iii) Mixing of viscous materials
(iv) Mixing of Solid with solid
(v) Mixing of gases with liquids
4.3 The flow pattern in agitated vessel
4.4 Methods of prevention of swirling and vortex formation, baffling
4.5 Different impellers, propellers, paddles used in mixing operation

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5.0 TRANSPORTATION AND STORAGE

5.1 Objectives of transportation and storage
5.2 Transportation of solid by belt conveyor, apron conveyor, screw Conveyor, bucket elevators, scrapers and pneumatic conveyers
5.3 Storage and handling of solids; construction and uses of silos and bins.

Syllabus Coverage up to I.A
Chapter 1,2,3,4

E. Books Recommended :

Sl.No	Name of Authors	Title of the Book	Name of Publisher
1	Badgero and Banchero	Introduction to Chemical Engineering	TMH Publication
2	W.L.Mc.Cabe & J.M.Smith	Unit Operation of Chemical Engineering	TMH Publication
3	K A Gavane	Unit Operation-1	Nirali Prakashan

Th4. INDUSTRIAL STOICHIOMETRY

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		End Semester Examination:	80
Maximum marks:	100		

A. Rationale:

In process industries raw materials are processed to get different products. The components present in the raw material combine in a definite proportion and the percentage of product formed depend on various parameters like temperature and pressure etc. It is highly essential to know the stoichiometry ratio and proportions and the process conditions to achieve maximum product formation and recycle of the unused materials for better economy. Therefore, knowledge of stoichiometry is the first and foremost requirement for the success of a chemical engineer.

B. Objective :

On completion of study of industrial stoichiometry the student will be able to:

(i) Differentiate between different units and dimensions, dimensional analysis and solve relevant problems
(ii) Compare density, specific gravity etc. of gaseous mixtures
(iii) Estimate quantitative requirement of materials for a chemical reaction
(iv) Understand the concept of equilibrium vapourization and condensation
(v) Workout raw material requirement for a chemical process from material balance equation
(vi) Calculate energy requirement for a chemical process from energy balance equation

C.	**Topic wise distribution of periods**	
Sl. No.	Topics	Periods
1	Units and dimension	03
2.	Mole Concept	05
3.	Stoichiometry	15
4.	Gases and Gaseous mixture	12
5.	Material balance without chemical reaction	15
6.	Material Balance involving chemical reaction	10
	Total	60

COURSE CONTENT

1.0 UNITS AND DIMENSIONS

1.1 Basic and derived units used in process industry.
1.2 Solve numerical on unit conversion from one unit to SI unit.

1.3 Dimension and application of dimensional analysis.
1.4 Different graphs used in industry.

2.0 MOLE CONCEPT

2.1 Mole, mole fraction, mass fraction
2.2 Mole concept with respect to chemical equation.
2.3 Principle of atom conservation.
2.4 Elementary problems on mole concept.
2.5 Methods of expressing composition of mixtures and solutions

3.0 STOICHIOMETRY

3.1 Stoichiometry.
3.2 Basis of Calculation
3.3 Concept of limiting reactants.
3.4 Atomic weight, molecular weight, molecular formula, empirical formula and solve some problems on it
3.5 Solve problems on chemical reaction on mass-mass, mass-volume basis

4.0 GASES AND GASEOUS MIXTURES

4.1 Ideal gas law.
4.2 Average molecular weight, density and composition (by weight and volume) of gas mixture and solve problems on it .
4.3 Partial pressure, vapour, Amagat's law, Dalton's law and solve problems on it .
4.4 State Roult's law and Henry's law and solve problems.

5.0 MATERIAL BALANCE WITHOUT CHEMICAL REACTION

5.1 State Law of conservation of mass
5.2 Concept of material balance
5.3 Solve problems on material balance based on Unit operations like mixing, evaporation, distillation, drying, humidification, extraction, absorption

6.0 MATERIAL BALANCE INVOLVING CHEMICAL REACTION

6.1 Law of conservation of mass
6.2 Stoichiometric ratio, Stoichiometric proportions, excess reactants, percentage excess, conversion, yield, selectivity.
6.3 Concept and reaction mechanism in combustion.
6.4 Solve problems on material balance with chemical reaction and combustion.
6.5 Concept of recycle and by pass.
6.6 Combustion, Excess air, Problems related to combustion

Syllabus Coverage up to I.A
Chapter 1,2,3,4

E. Books Recommended :

Name of Authors	Title of the Book	Name of Publisher
Hougen and Watson	Chemical process principle	CBS Publication
K A Gavane	Introduction to Process Calculation	Nirali Prakasan
Bhatt & Vora	Stoichiometry	TMH Publication

Th5. ENVIRONMENTAL STUDIES

(Common to all Branches)

Name of the Course: Diploma in Electrical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination :	3 hrs
Theory periods:	4P / week	Internal Assessment:	20
Maximum marks:	100	End Semester Examination ::	80

A. RATIONALE:

Due to various aspects of human developments including the demand of different kinds of technological innovations, most people have been forgetting that, the Environment in which they are living is to be maintained under various living standards for the preservation of better health. The degradation of environment due to industrial growth is very much alarming due to environmental pollution beyond permissible limits in respect of air, water industrial waste, noise etc. Therefore, the subject of Environmental Studies to be learnt by every student in order to take care of the environmental aspect in each and every activity in the best possible manner.

B. OBJECTIVE:

After completion of study of environmental studies, the student will be able to:

1. Gather adequate knowledge of different pollutants, their sources and shall be aware of solid waste management systems and hazardous waste and their effects.
2. Develop awareness towards preservation of environment.

C. Topic wise distribution of periods:

Sl. No.	Topics	Perio
1	The Multidisciplinary nature of environmental studies	04
2	Natural Resources	10
3	Systems	08
4	Biodiversity and it's Conservation	08
5	Environmental Pollution	12
6	Social issues and the Environment	10
7	Human population and the environment	08
	Total:	**60**

D. COURSE CONTENTS

1. The Multidisciplinary nature of environmental studies:

1.1 Definition, scope and importance.

1.2 Need for public awareness.

2. Natural Resources:

Renewable and non renewable resources:

2.1 Natural resources and associated problems.

2.1.1. Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction mining, dams and their effects on forests and tribal people.

2.1.2. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.

2.1.3. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.

2.1.4. Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity, .

2.1.5. Energy Resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

2.1.6. Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.

2.2 Role of individual in conservation of natural resources.

2.3 Equitable use of resources for sustainable life styles.

3. **Systems:**

3.1. Concept of an eco system.

3.2. Structure and function of an eco system.

3.3. Producers, consumers, decomposers.

3.4. Energy flow in the eco systems.

3.5. Ecological succession.

3.6. Food chains, food webs and ecological pyramids.

3.7. Introduction, types, characteristic features, structure and function of the following eco system:

3.8. Forest ecosystem:

3.9. Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries).

4. **Biodiversity and it's Conservation:**

4.1. Introduction-Definition: genetics, species and ecosystem diversity.

4.2. Biogeographically classification of India.

4.3. Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and optin values.

4.4. Biodiversity at global, national and local level.

4.5. Threats to biodiversity: Habitats loss, poaching of wild life, man wildlife conflicts.

5. **Environmental Pollution:**

5.1. Definition Causes, effects and control measures of:

5.1.1 Air pollution.
5.1.2 Water pollution.
5.1.3 Soil pollution
5.1.4 Marine pollution
5.1.5 Noise pollution.
5.1.6 Thermal pollution
5.1.7 Nuclear hazards.

5.2. Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
5.3. Role of an individual in prevention of pollution.
5.4. Disaster management: Floods, earth quake, cyclone and landslides.

6. **Social issues and the Environment:**

6.1. Form unsustainable to sustainable development.
6.2. Urban problems related to energy.
6.3. Water conservation, rain water harvesting, water shed management.
6.4. Resettlement and rehabilitation of people; its problems and concern.
6.5. Environmental ethics: issue and possible solutions.
6.6. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.
6.7. Air (prevention and control of pollution) Act.
6.8. Water (prevention and control of pollution) Act.
6.9. Public awareness.

7. **Human population and the environment:**

7.1. Population growth and variation among nations.
7.2. Population explosion- family welfare program.
7.3. Environment and human health.
7.4. Human rights.
7.5. Value education
7.6. Role of information technology in environment and human health.

Syllabus coverage up to Internal assessment

Chapters: 1, 2 and 3.

Learning Resources:

Sl.No	Title of the Book	Name of Authors	Name of Publisher
1.	Textbook of Environmental studies	Erach Bharucha	#UGC
2.	Fundamental concepts in Environmental Studies	D.D. Mishra	S.Chand & Co-Ltd
3.	Text book of Environmental Studies	K.Raghavan Nambiar	SCITECH Publication Pvt. Ltd.
4.	Environmental Engineering	V.M.Domkundwar	Dhanpat Rai & Co

Pr1. PHYSICAL CHEMISTRY LABORATORY

(Common to Chemical, Biotechnology & Food Technology)

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	45	Examination	3 hrs
Lab. periods:	3P / week	Sessional:	25
Maximum marks:	75	End Semester Examination:	50

A. RATIONALE: In view of the fact that there are, as a rule, available for laboratory work' not more than two and one-half hours at a time, it has been found desirable to have the different pieces of apparatus set up beforehand by the instructor. To this end, each experiment is preceded by an exact list of the apparatus and chemicals needed. It is believed that this will materially aid the instructor in assembling the necessary equipment. At the Rensselaer Polytechnic Institute, the laboratory course immediately follows the completion of the theoretical course in physical chemistry, and students are thus prepared to take up the study of any experiment herein listed. It is therefore found practical to prepare the equipment for one or two units of each exercise before the laboratory course starts, and to shift the student successively from one experiment to another. In this way, an excessive amount of preparatory work is avoided.

B. OBJECTIVE:

On completion of the lab course the student will be able to:

1. Understand the interconnection between experimental foundation and underlying theoretical principles and to appreciate the limitations inherent in both theoretical treatments and experimental measurements.
2. Gain familiarity with a variety of physico-chemical measurement techniques.
3. Develop laboratory skills and the ability to work independently.
4. Name salts, acids, bases and covalent compounds and provide formulas for these given a molecular formula.
5. Explain the difference between solubility and dissociation in water and apply this knowledge to acids, bases and salts.

List of experiments:

Sr No	Name Of Experiment	No of Periods
1	Preparation of standard solution of an acid and alkali	06
2	Determine the viscosity of a liquid by Red wood viscometer at different temperatures and plotting graph between viscosity and temperature.	06
3	To determine the partition coefficient of iodine between water and carbon tetrachloride.	06
4	To determine the partition coefficient of benzoic acid between water and benzene at room temperature and molecular state of Benzoic acid in benzene as compared to its solution in water.	06
5	To prepare colloidal solution of starch.	06
6	To prepare colloidal solution of egg albumin.	06
7	Determine the solubility of a given salt at room temperature and also draw its solubility curve.	06
8	To determine the adsorption isotherm of acetic acid by activated charcoal.	06
9	To investigate the adsorption of oxalic acid from aqueous solution of activated charcoal and examines the validity of Freundlich and Langmuir's adsorption isotherm.	06
10	To determine the rate constant for hydrolysis of ethyl acetate catalysed by hydrochloric acid	06

REFERENCE BOOKS

1. Laboratory Manual on Engineering Chemistry
   by Dr S Basin and Dr. Sudha Rani Dhanpat Rai Publishing company

Pr2. FLUID MECHANICS LABORATORY

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	45	Examination	3 hrs
Lab. periods:	3P / week	Sessional:	25
Maximum marks:	50	End Semester Examination:	25

A. Rational

1. This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices.

2. Energy conversion principles, analysis and understanding of pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristics curves.

B.Objective

1. Perform experiments to determine the coefficient of discharge of flow measuring devices.

2. Conduct experiments on hydraulic turbines and pumps to draw characteristics.

3. Test basic performance parameters of pumps and execute the knowledge in real life situations.

4. Determine the energy flow pattern through pumps.

5. Exhibit his competency towards preventive maintenance of pumps.

List of experiments:

Sr No	Name Of Experiment	No of Periods
1	Demonstrate operation of different types of manometers	03
2	Demonstrate operation of Reynolds's apparatus and find out critical velocity	06
3	Verify Bernoulli's equation	06
4	Demonstrate operation of venturimeter and determine the venturi co-efficient	03
5	Demonstrate operation of Orifice meter and determine the Orifice co-efficient	03
6	Determine co-efficient of friction and friction losses in pipes	03
7	Demonstrate operation of a Rota meter and determine rate of flow through Rota meter	03
8	Demonstrate the flow over a weir or 'V' notch	03
9	Demonstrate operation of a fluidized bed column	03
10	Demonstrate operation of a centrifugal pump and valves	03
11	Demonstrate operation of Helical Coil and determine pressure drop through the coil.	03
12	Basic plumbing practice	06
	Total	45

Name of Authors	**Title of the Book**	**Publication**
Dr Baljeet S Kapoor	Experiments in fluid mechanics	Khanna Publication
S. K. Lekhi	Hydraulics-Laboratory manual	Wiley eastern Limited

Pr3. MECHANICAL OPERATIONS LABORATORY

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	45	Examination	3 hrs
Lab. periods:	3P / week	Sessional:	25
Maximum marks:	50	End Semester Examination:	25

A. Rational:

To understand the importance of various mechanical operations used in process industry. To apply principles of basic sciences and chemical engineering for designing various size reduction, size separation and conveying equipments.

B. Objective:

At the end of the laboratory course, students will be able
1. To apply the principles of unit operations through experimentation and
2. To demonstrate the ability to understand the various equipments used in chemical and allied process industry

List of Experiments :

Sr No	Name Of Experiment	No of Periods
1	Demonstrate operation of a Blake type jaw crusher and Verify Rittinger's Law and the capacity of jaw crusher	03
2	a. Demonstrate operation of a Ball mill b. Find-out the critical speed of a ball mill and compare with the actual speed c. Determine the effect the number of balls and time of grinding and plot a graph between the no. of balls Vs. Time	06
3	Demonstrate operation of sieve shaker and determine the average size of the product after performing separation size separation by screen analysis	06
4	Demonstrate operation of vibrating screen & find-out its screen efficiency	03
5	Demonstrate operation of froth flotation cell and Concentrate the given coal sample and find out the ash present after and before concentration	03
6	Perform the batch sedimentation test and plot a graph between height of the dead zone and time	03
7	Demonstrate operation of a magnetic separator	03
8	Demonstrate operation of cyclone separator and estimate its efficiency	03
9	Demonstrate operation of Wilflay table	03
10	Demonstrate operation of a centrifuge	03
11	Demonstrate operation of a classifier	03
12	Determine operation of a paddle mixer	03
13	Demonstrate operation of filter press.	03

Pr4. ENVIRONMENTAL ENGINEERING LABORATORY

(Common to Chemical, Biotechnology & Food Technology)

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	45	Examination	3 hrs
Lab. periods:	3P / week	Sessional:	25
Maximum marks:	25	End Semester Examination:	

A. Rationale:

Practicals are an integral part of understanding and learning a particular subject. For the course in Environmental Science, practical include field studies, laboratory exercises (analysis), and creative activities. These exercises are not only relevant to get a better understanding of environment but also provide hands-on experience at devising methods for preventing environmental degradation.

B. Objective:

On completion of the lab course the student will be able to determine:

1. dissolved oxygen in the given sample of water.
2. Biological Oxygen Demand (BOD) of a given sample of water.
3. chemical oxygen demand (COD) of a water sample .
4. the pH and Conductivity and turbidity of given water samples.
5. pH and conductivity of soil/ sludge samples.
6. total dissolved solid in the given water sample

EXPERIMENT Wise Distribution of Periods

SR NO	EXPERIMENT	PERIODS
1	Collection of sample of waste water	03
2	Analyze a given sample of waste water for estimation of dissolved chloride	06
3	Determine the dissolved oxygen content of water by Winkler's method	06
4	Determine the chemical oxygen demand (BOD) exerted by a given sample of waste water	06
5	Determine the chemical oxygen demand (COD) of a given sample of waste water`	06
6	Determine the turbidity of a given sample of waste water	03
7	Determine the total dissolved solid in a given sample of waste water	06
8	Determine the optimum amount of Coagulant required to treat to turbid water	03
9	Determine the amount of sulphate in a given sample of water.	06
	Total	45

Name of Authors	**Title of the Book**	**Publication**
Dr S Basin and Dr. Sudha Rani	Laboratory Manual on Engineering Chemistry	Dhanpat Rai Publishing company

Pr5. CHEMICAL ENGINEERING DRAWING

Name of the Course: Diploma in Chemical Engineering			
Course code:		Semester	3rd
Total Period:	60	Examination	3 hrs
Lab. periods:	4P / week	Sessional:	25
Maximum marks:	75	End Semester Examination:	50

A. Rationale:

Chemical Engineering Drawing gives a hands on practice of drawing the equipment, exposure to actual flow of material in a chemical plant and understanding of process utility and control system .

B. Objective:

On completion of the lab course the student will be able to draw:

1. symbols and free handsketch of chemical engineering process equipment.
2. Process instrumentation diagram

Topic wise distribution of periods

Sl. No.	Topics	Periods
1.	Symbol of Chemical Equipment	10
2.	Sketches of Chemical Engineering Equipment	15
3.	Process Instrumentation Diagram	20
	Total	

COURSE CONTENT

1.0 SYMBOLS

1.1 Draw symbols of equipment used in chemical industries

1.2 Draw symbol of pipe line, valves, pumps, compressor, heating cooling arrangements, furnaces, boilers, process vessels, Storage vessels, driers, separators, filters, centrifuge, stirrer, feeder, conveyor

2.0 SKETCH OF CHEMICAL ENGG. EQUIPMENT

2.1 Draw sketch of Chemical Engineering Equipment like

(i) Heat exchanger (double pipe and shell & tube type)
(ii) Distillation column
(iii) Dryer
(iv) Evaporator
(v) Ball mill
(vi) Cyclone Separator
(vii) Crystalliser
(viii) Absorber
(ix) Extractor

3.0 PROCESS INSTRUMENTATION DIAGRAM

3.1 Draw symbols of flow rate indictor, flow recorder, level indicator, pH recorder, level controller,

3.2 Draw P.I. diagrams of

(i) Cooler temperature control
(ii) Reactor temperature control
(iii) Heater temperature control
(iv) Hot fluid temperature control
(v) Evaporator circulation control
(vi) Tray dryer control
(vii) Top temperature control of distillation column
(viii) Control of level and reflux condenser
(ix) Steam flow rate and level control of reboiler

3.3 Utility Line diagram

(i) Service fluid code for piping
(ii) Utility block diagram for steam
(iii) Utility block diagram for chilled water

Name of Authors	**Title of the Book**	**Publication**
C. Dryden	Output lines of Chemical Technology	CBS Publishing company
K. A. Ghavane	Chemical Engineering Drawing	Nirali Publication
Dr Srikant D. Dawande	Process Equipment Design Vol 1 & Vol 2	Dennet Publication