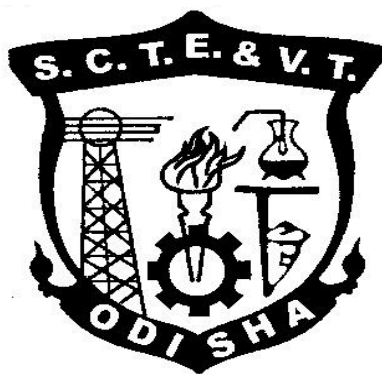


CURRICULLUM OF 5TH SEMESTER
For
DIPLOMA IN CHEMICAL ENGINEERING
(Effective FROM 2020-21 Sessions)



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

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 5th Semester CHEMICAL ENGINEERING (wef 2020-21)

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Entrepreneurship and Management & Smart Technology	4	-	-	20	80	3	100
Th.2		Mass Transfer-2	4	-	-	20	80	3	100
Th.3		Chemical Process Industries-2	4	-	-	20	80	3	100
Th.4		Chemical Engineering Thermodynamics	4	-	-	20	80	3	100
Th.5		Instrumentation & Chemical Analysis *	4	-		20	80	3	100
		Total	20		-	100	400	-	500
		Practical							
Pr.1		Instrumentation Laboratory*	-	-	6	50	50	3	100
Pr.2		Mass Trasfer-2 Laboratory	-	-	6	50	50	3	100
Pr.3		Project Phase-I	-	-	4	50	-	-	50
		Student Centred Activities(SCA)	-	-	3	-	-	-	-
		Total	-	-	19	150	-	-	-
		Grand Total	20	0	19	250	500	-	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. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY

(Common to All Branches)

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	TOTAL	60

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0

In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.

OBJECTIVES

After undergoing this course, the students will be able to :

- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

DETAILED CONTENTS**1. Entrepreneurship**

- Concept /Meaning of Entrepreneurship
- Need of Entrepreneurship
- Characteristics, Qualities and Types of entrepreneur, Functions
- Barriers in entrepreneurship

- Entrepreneurs vrs. Manager
- Forms of Business Ownership: Sole proprietorship, partnership forms and others
- Types of Industries, Concept of Start-ups
- Entrepreneurial support agencies at National, State, District Level(Sources): DIC, NSIC, OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
- Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. **Market Survey and Opportunity Identification (Business Planning)**

- Business Planning
- SSI, Ancillary Units, Tiny Units, Service sector Units
- Time schedule Plan, Agencies to be contacted for Project Implementation
- Assessment of Demand and supply and Potential areas of Growth
- Identifying Business Opportunity
- Final Product selection

3. **Project report Preparation**

- Preliminary project report
- Detailed project report, Techno economic Feasibility
- Project Viability

4. **Management Principles**

- Definitions of management
- Principles of management
- Functions of management (planning, organising, staffing, directing and controlling etc.)
- Level of Management in an Organisation

5. **Functional Areas of Management**

- a) Production management
 - Functions, Activities
 - Productivity
 - Quality control
 - Production Planning and control
- b) Inventory Management
 - Need for Inventory management
 - Models/Techniques of Inventory management
- c) Financial Management
 - Functions of Financial management
 - Management of Working capital
 - Costing (only concept)
 - Break even Analysis
 - Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)
- d) Marketing Management
 - Concept of Marketing and Marketing Management
 - Marketing Techniques (only concepts)
 - Concept of 4P s (Price, Place, Product, Promotion)
- e) Human Resource Management
 - Functions of Personnel Management

- Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages
6. **Leadership and Motivation**
- a) Leadership
 - Definition and Need/Importance
 - Qualities and functions of a leader
 - Manager Vs Leader
 - Style of Leadership (Autocratic, Democratic, Participative)
 - b) Motivation
 - Definition and characteristics
 - Importance of motivation
 - Factors affecting motivation
 - Theories of motivation (Maslow)
 - Methods of Improving Motivation
 - Importance of Communication in Business
 - Types and Barriers of Communication
7. **Work Culture, TQM & Safety**
- Human relationship and Performance in Organization
 - Relations with Peers, Superiors and Subordinates
 - TQM concepts: Quality Policy, Quality Management, Quality system
 - Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)
8. **Legislation**
- a) Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
 - b) Features of Factories Act 1948 with Amendment (only salient points)
 - c) Features of Payment of Wages Act 1936 (only salient points)
9. **Smart Technology**
- Concept of IOT, How IOT works
 - Components of IOT, Characteristics of IOT, Categories of IOT
 - Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

Syllabus to be covered before IA: Chapter 1,2,3,4

RECOMMENDED BOOKS

1. Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
2. Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
3. Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
4. Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
5. Industrial Engineering and Management by Banga and Sharma, Khanna Publications
6. Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
7. Online Resource on Startups and other concepts
8. <https://www.fundable.com/learn/resources/guides/startup>

Th. 2 MASS TRANSFER – II

Name of the Course: Diploma in Chemical Engineering			
Course Code		Semester	5 th
Total Periods	60	Examination	3 hours
Theory Periods:	4P/Week	Class Test Marks:	20
Tutorial	1P/ Week	End Semester Examination Marks	80
Maximum Marks:	100		

A. Rationale:

Mass Transfer is the Basic Subject of Chemical Engineering. A Chemical Engineer should know that how an operation is taking place in process industry. Mass Transfer tells us the mechanisms and Concentrations between different phases. All the basic operations in industries are based upon mass transfer. Some important are Distillation (most important process in Petroleum Industry is Fractional distillation), Absorption, Adsorption are taught in Mass Transfer- I and other mass transfer operations are Leaching, Solvent Extraction or Liquid Liquid Extraction, crystallization is in Mass Transfer-2. So to understand the mechanism of transfer due to difference in concentrations is explained by mass Transfer.

B. OBJECTIVES:

After completion of MASS TRANSFER-II the student will be able to

1. Understand the concepts of mass transfer operations like humidification, drying, extraction and crystallization and membrane separation.
2. Understand working principle of various mass transfer equipment used in industry and its application.
3. Solve simple problems of mass transfer

C.	Topic Wise Distribution of Periods	
SL. No.	Topics	Period
1	Humidification Dehumidification	15
2	Drying	15
3	Extraction	15
4	Crystallization	15
	Total	60

D. Chapter – 1 Humidification and Dehumidification

- 1.1 Wet and dry bulb temperature
- 1.2 The principle of wet blub temperature theory
- 1.3 Illustrate humidity chart and explain different methods of measurement of Humidity
- 1.4 Different methods of humidification and dehumidification
- 1.5 The construction and working of natural and mechanical draft cooling tower.
- 1.6 Solve simple problems

Chapter – 2 Drying

- 2.1 Define drying
- 2.2 Moisture content-equilibrium, unbound, free moisture
- 2.3 The methods of removing liquids from solids
- 2.4 Illustrate constant rate and falling rate period (simple problems)
- 2.5 The construction and working principle of tray dryer, rotary dryer, spray dryer, tunnel dryer, flash dryer, fluidized bed dryer, dryer for heat sensitive materials.
- 2.6 Solve simple problems

Chapter – 3 Extraction

- 3.1 Liquid extraction and leaching
- 3.2 Different types of extraction
- 3.3 The principle of solid liquid extraction
- 3.4 Batch and continuous leaching, Solid-Liquid extraction equipments
- 3.5 The principal of liquid-liquid extraction
- 3.6 The parameter in choice of solvent for liquid-liquid extraction
- 3.7 Construction and working principle of liquid-liquid extraction equipment and solid liquid extraction equipment
- 3.8 Solve simple problems

Chapter – 4 Crystallization

- 4.1 Define crystallization
- 4.2 Principle of crystallization
- 4.3 Construction and working of different types of batch and continuous crystallizer
- 4.4 Solve simple problems

Syllabus Coverage up to I.A

Chapter 1,2

E. Book Recommended			
Sr no	Name of Author	Title of Book	Name of Publisher
1	Treybal.	Mass transfer operation	Tata Mc Grawhill
2	McCabe & J M Smith	Unit operation of Chemical Engineering	Tata Mc Grawhill
3	Badgero and Banchero	Introduction to Chemical Engineering	Tata Mc Grawhill
4	K Gavane	Unit operations II	Nirali Publication
5	Richardson & Coulson	Chemical Engineering Vol-2	Tata Mc Grawhill

Th. 3 CHEMICAL PROCESS INDUSTRIES – II

Theory:4 Periods per Week	Internal Assessment: 20 Marks
Total periods:60 Periods	Term End Examination: 80 Marks
Examination: 3 Hours	Total Marks: 100 Marks

A. Rationale:

The chemical industry comprises the companies that produce industrial chemicals. Central to the modern world economy, it converts raw materials (oil, natural gas, air, water, metals, and minerals) into different products. In this subject, we will be learning the technology used, process parameters and flow of raw materials into finished products in a chemical industry. Various professionals are deeply involved in the chemical industry including chemical engineers, scientists, lab chemists, technicians, etc. Chemical industry in India is highly diversified, covering more than 80,000 commercial products. It is broadly classified into Bulk chemicals, Specialty chemicals, Agrochemicals, Petrochemicals, Polymers and Fertilizers. India's proximity to the Middle East, the world's source of petrochemicals feedstock, makes for economies of scale.

India is a strong global dye supplier, accounting for approximately 16% of the world production of dyestuff and dye intermediates. Upcoming Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs) and Plastic parks will provide state-of-the-art infrastructure for Chemicals and Petrochemicals sector.

- The Indian chemicals industry is projected to reach \$304 bn by 2025
- Indian ranks 14th in export and 8th in import of chemicals (Excluding Pharmaceuticals products) globally
- Demand of chemical products is expected to grow at approximately 9% p.a. over the next 5 years
- Indian chemical industry employs more than 2 million people

B. OBJECTIVES:

After completion of Chemical Process Industries -II the student will be able to

1. Understand the adequate information about raw materials.
2. Describe the chemistry involved and outlines of manufacturing of some organic chemicals and polymers which are of highly significant in daily life.

C. Topic Wise Distribution of Periods

SL. No.	Topics	Period
1	Pesticides	06
2	Paints and varnishes	06
3	Explosives	06
4	Plastics	06
5	Synthetic fiber	06
6	Rubber	06
7	Sugar	06
8	Oils and fats	06
9	Soaps and detergent	06
10	Pharmaceutical Industry	06
	Total	60

Chapter 1.0 PESTICIDES

- 1.1 Define pesticides
- 1.2 Classify different pesticides
- 1.3 Manufacture of DDT

Chapter 2.0 PAINTS AND VARNISHES

- 2.1 Define paints, varnishes, lacquers, enamels and their components, application
- 2.2 Constituents of paints and their characteristics
- 2.3 Manufacturing process of paints and varnishes
- 2.4 latest advances in paint technology

Chapter 3.0 EXPLOSIVES

- 3.1 Define explosives
- 3.2 Classify different explosives
- 3.3 Manufacture of cellulose nitrate, nitroglycerine and dynamite

Chapter 4.0 PLASTICS

- 4.1 Manufacture of different plastics like phenol formaldehyde, urea formaldehyde, polyethylene, P.V.C with their properties and uses.

Chapter 5.0 SYNTHETIC FIBERS

- 5.1 Classify fiber
- 5.2 Explain manufacture of different fibers like Nylon, Viscose rayon, Cupro ammonium rayon, Acetate rayon, Polyester with properties.

Chapter 6.0 RUBBER

- 6.1 Natural and synthetic rubber
- 6.2 Manufacture of SBR and Nitrile rubber and their properties

Chapter 7. SUGAR

- 7.1 Manufacture of cane sugar
- 7.2 Manufacture of industrial alcohol
- 7.3 Classification of alcoholic beverages
- 7.4 Manufacture of Beer

Chapter 8. OILS AND FATS

- 8.1 Classify different types of oil
- 8.2 Manufacture of vegetable oil
- 8.3 Hydrogenation of oil
- 8.4 Latest developments in edible oil production

Chapter 9. SOAPS AND DETERGENTS

- 9.1 Define soaps and detergent
- 9.2 Manufacture of soap
- 9.3 Manufacture of detergent

Chapter 10. PHARMACEUTICAL INDUSTRY

- 10.1 Classification of pharmaceutical industry
- 10.2 Major pharmaceutical industry in India and their products
- 10.3 manufacture of penicillin by fermentation

Syllabus Coverage up to I.A

Chapter 1,2,3,4,5

E. Book Recommended			
Sr no	Name of Author	Title of Book	Name of Publisher
1	Dryden	Outline of Chemical Technology	East West Press
2	N Shreeve	Chemical Technology	Tata Mc Grawhill

Th. 4 CHEMICAL ENGINEERING THERMODYNAMICS

Theory:4 Periods per Week	Internal Assessment: 20 Marks
Total periods:60 Periods	Term End Examination: 80 Marks
Examination: 3 Hours	Total Marks: 100 Marks

A. Rationale:

Thermodynamics, as the name indicates, is concerned with the flow of heat and it deals with energy charges accompanying all types' physical and chemical processes. The principle of Chemical Engineering thermodynamics will help in process design and analysis for arriving at optimum economic results. Therefore, knowledge of laws of thermodynamics, P-V-T- Relationship of gas is necessary for the success of chemical engineers.

B. OBJECTIVES:

After completion of study of Chemical Engineering Thermodynamics, the student will be able to

1. Understand concept of system and surrounding, application of different laws of thermodynamics, their application and feasibility in a chemical reaction.
2. Understand the phase of a system, thermodynamics of water system and critical phenomena and liquefaction of gases.

C. Topic Wise Distribution of Periods

Sl. No.	Topics	Period
1	Introduction & Basic Concept	10
2	First law of thermodynamics	13
3	P-V-T Behavior & Heat Effect	14
4	Second Law of Thermodynamic	13
5	Thermodynamic Properties of pure fluid	10
	Total	60

D. CHAPTER-1 INTRODUCTION AND BASIC CONCEPTS

- 1.1 Scope and limitations of Thermodynamics.
- 1.2 System, processes, state, properties, and path function, heat and work.
- 1.3 Equilibrium state and phases.
- 1.4 Zeroth law of Thermodynamics.
- 1.5 The concept of heat reservoir, heat engine, and heat pump.
- 1.6 Reversible and irreversible process.
- 1.7 Solve simple problems.

CHAPTER-2 FIRST LAW OF THERMODYNAMICS.

- 2.1 State and explain first law of Thermodynamics.
- 2.2 Concept of internal energy, Enthalpy, heat capacity.
- 2.3 First law of thermodynamics for cyclic process, non-flow process, and flow process.
- 2.4 Solve numerical on application of 1ST law of thermodynamics.

CHAPTER-3 P-V-T BEHAVIOUR AND HEAT EFFECT.

- 3.1. P-V-T behavior of pure fluid.
- 3.2. Equation of state and ideal gas.
- 3.3. Constant volume process, constant pressure process, constant temperature process, adiabatic process, polytropic process for ideal gases.

CHAPTER-4 SECOND & THIRD LAW OF THERMODYNAMICS AND APPLICATION.

- 4.1. State and explain second law of thermodynamics.
- 4.2. Concept of entropy.
- 4.3. Calculate change of entropy for various conditions.
- 4.4. Third law of Thermodynamics.

CHAPTER-5 THERMODYNAMIC PROPERTIES OF PURE FLUIDS.

- 5.1. Classify thermodynamic properties.
- 5.2. Work function and Gibb's free energy and Gibb's phase rule.
- 5.3. Various relationships among thermodynamic properties – maxwell equation, clapeyron equation, entropy-heat capacity relation, differential equation for entropy, effect of temperature, pressure and volume on U,H and S, relationship between C_p and C_v .
- 5.4. Gibb's-Helmholtz equation.
- 5.5. Fugacity co-efficient, effect of temperature and pressure on fugacity, fugacity of pure gases, solids and liquids.
- 5.6. Concept of activity, Effect of pressure and temperature on activity.
- 5.7. Concept of Refrigeration and liquefaction process.

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

E. Book Recommended			
Sr no	Name of Author	Title of Book	Name of Publisher
1	Smith and Van ness	Introduction to chemical Engineering Thermodynamics	Tata Mc Grawhill
2	K V Narayanan	A text book of chemical engineering Thermodynamics	PHI
3	Sandler	Chemical Engineering Thermodynamics	John Wiley

Th.5 Instrumentation & Chemical Analysis

(Common to Chemical Engineering, Biotechnology & Food Technology)

Theory:4 Periods per Week	Internal Assessment: 20 Marks
Total periods:60 Periods	Term End Examination: 80 Marks
Examination: 3 Hours	Total Marks: 100 Marks

A. Rationale:

Number of control equipment and measuring devices are used in the operation of chemical engineering unit operation equipment to control of process variable, these variables like temperature, pressure, level, viscosity, density, refractive index etc. affect the processing equipment and ultimately affect the product quality. It is necessary to study the principle of operation of process variables measuring devices, so that they may be used either on-line or off line for this purpose.

B. Objectives :

After completion of study of Instrumentation and Process Control the student will be able to :

1. Understand working principle, construction, repair and maintenance of measuring instrument and their used to control chemical engineering unit operations and processes.
2. Operate modern analytical instruments for measuring process parameters

TOPIC WISE DISTRIBUTION OF PERIODS

SL. No.	Topic	Periods
1	Instrument	05
2	Measurement	10
3	pH measurement	05
4	Temperature measurement	10
5	Pressure measurement	10
6	Automatic control	20
	Total	60

Chapter 1.0 INSTRUMENT

- 1.1 Instruments and its importance
- 1.2 Standards of measurement
- 1.3 Functional elements of instruments
- 1.4 Performance characteristics of an instrument

Chapter 2.0 MEASUREMENTS OF CHARACTERISTICS

- 2.1 Measurement of viscosity by Red Wood Viscometer, Falling Sphere Viscometer, Continuous Viscometer
- 2.2 Principle and uses of spectrophotometer
- 2.3 Principle and uses of polarimeter
- 2.4 Measurement of refractive index by Refractometer

Chapter 3.0 pH & CONDUCTIVITY MEASUREMENT

- 3.1 Measurement of pH
- 3.2 Measurement of electrical conductivity

Chapter 4.0 TEMPERATURE MEASUREMENT

- 4.1 Different temperature scales.
- 4.2 Different methods of temperature measurement.
- 4.3 Temperature measurement by liquid in glass thermometer
- 4.4 Describe temperature measurement on electrical phenomena – like thermocouple, resistance thermometer, optical pyrometer, radiation pyrometer.

Chapter 5.0 PRESSURE MEASUREMENT

- 5.1 Different types of pressure
- 5.2 Different methods of measurement of pressure.
- 5.3 Pressure measurement by Bourdon tube, Bellows
- 5.4 Maintenance and repair of pressure measuring instruments.

Chapter 6.0 AUTOMATIC CONTROL

- 6.1 Automatic control system and explain the application with example.
- 6.2 Elementary idea about transfer functions for a first order system and time constant.
- 6.3 Block diagram and components of Process Control system
- 6.4 Types of process control system, advantages and disadvantages
- 6.3 Elementary idea about different types of automatic controllers.
- 6.4 Principle of PLC, computer Aided measurement and control

Syllabus Coverage up to I.A

Chapter 1,2,3,4

E. Book Recommended			
Sr no	Name of Author	Title of Book	Name of Publisher
1	D.P. Eckman	Industrial Instrumentation	CBS Publication
2	S.K. Singh	Industrial Instrumentation and control	Tata Mc Grawhill
3	A.K. Srivastava	Instrumental Approach to Chemical Analysis	S Chand

Pr.1 INSTRUMENTATION LABORATORY

Common to Chemical, Biotechnology & Food Technology

Practical:6 Periods per Week	Sessional: 50 marks
Total periods:90 Periods	Practical Examination: 50 marks
Examination: 3 Hours	Total Marks: 100 Marks

A. Rationale:

An instrument is a device that measures or manipulates process physical variables such as flow, temperature, level, or pressure etc. Instrumentation is the basic process control in industry. In industrial control a wide number of variables temperature, flow, level, pressure, and distance can be sensed simultaneously. Structure of Industrial Instrumentation in Real Time Applications includes for measuring, regulating physical quantities such as flow, level, pressure, temperature and so on. Output instrumentation includes control devices such as valves, regulators, circuit breakers and relays.

Students will gain skill to handle, measure and care of different instruments used in the process industry.

B. Objectives :

After completion of study of Instrumentation and Process Control the student will be able to :

1. Understand working principle, construction, repair and maintenance of pH Meter, Polari meter, Refracto meter, Viscometer used in industry
2. Understand the principle of measuring instruments.

List of EXPERIMENTS

SL. No.	Experiment
1	Separation of Iron using solvent extraction technique
2	Determine pH and conductivity of a given solution by pH-meter
3	Determine the concentration of sugar in sugar solution by Polarimeter
4	Determine the refractive index of different liquids by Abbe's Refractometer
5	To determine a) Maximum wavelength of a solution of cobalt chloride b) Verify Beer's Law and apply it to find the concentration of the given unknown solution by Spectrophotometer
6	To verify Beer's law of solution of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ using calorimeter
7	Demonstrate different types of pressure gauges and temperature measuring devices
8	Determine the viscosity of an Oil by Red Wood Viscometer at different temperature and plotting a graph between viscosity and temperature
9	Calibration of a thermocouple
10	Demonstrate function of digital multi-meter

Pr.2 MASS TRANSFER-2 LABORATORY

Practical:6 Periods per Week	Sessional: 50 marks
Total periods:90 Periods	Practical Examination: 50 marks
Examination: 3 Hours	Total Marks: 100 Marks

A. Rationale:

Mass transfer is one of the basic tenets of chemical engineering, and contains many practical concepts that are utilized in countless industrial applications.

Students will learn the principle of mass transfer operation through practically using Laboratory equipments used in the process industry.

B. Objectives :

After completion of Practical of Mass transfer-2, the student will be able to :

1. Understand working, construction and operation of Cooling Tower, Driers, Crystallisers used in industry
2. Understand the principle of mass transfer used in the Process industry

List of Experiments

SL. No.	Experiment
1	A) Demonstrate operation of a Cooling Tower B) To determine humidity, humid volume, humid heat, percentage of humidity by psychometric method.
2	A) Demonstrate operation of the wetted wall column B) Determine Psychometric parameter of outlet air
3	A) Demonstrate operation of a tray dryer (Vacuum / Atmospheric type) B) Plot the rate of drying curve for a given sample of wet solid
4	Demonstrate operation of a Fluidized bed dryer
5	A) Demonstrate operation of an open pan crystallizer B) Find the yield of crystal from a given solution
6	A) Demonstrate operation of Swanson Walker Crystallizer B) Determine the efficiency of equipment
7	A) Demonstrate operation of liquid-liquid extractor B) Separate a solution into its component by using liquid-liquid extraction method C) Demonstrate operation of a solid-liquid extractor
8	Demonstrate operation of spray tower
9	To determine the partition coefficient of Iodine between water and carbon tetrachloride
10	To determine the solubility of a given salt at room temperature and also draw its solubility curve
	Total

Pr 3. PROJECT WORK (Phase-I)

Name of the Course: Diploma in Chemical Engg.			
Course code:		Semester	5 th
Total Period:	60	Examination :	-
Theory periods:	4P / week	Sessional Marks	50
		TOTAL Marks	50

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Chemical Engineering and practices in real life situations, so as to participate and manage a Chemical Engg. Project in future.

Entire Project shall spread over 5th and 6th Semester. Part of the Project covered in 5th Semester shall be named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- To achieve real life experience in software/hardware design.
- To develop the skill of writing Project Report

General Guidelines

The individual students have different aptitudes and strengths and also areas of interest. Project work, therefore, should match the strengths and interest of the students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester). Students should be allotted a problem of interest to him/her as a project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual

assignment or a group assignment. Preferably there should not be more than 5 students, if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

Following are the broad suggestive areas of project work

- ✓ Processes based Project: Manufacture of product.
- ✓ Equipment based Project: Detailed design and fabrication of the equipment for a given capacity.
- ✓ Experimental based Project: Experimental investigation of basic or applied research problem.
- ✓ Industrial Problems: Any problem or project directly related to existing plants for modification of process or equipment or regarding pollution control and energy conservation under the guidance of a staff member and /or staff members and submit a typed report in duplicate.
- ✓ Research Oriented: Any application/renovation/modification of a latest technology

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

Project Phase-I and Phase-II

The Project work duration shall cover 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5th sem under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work including Design of the system have to be complete in Phase-I. Project Milestones are to be set so that progress can be tracked . In Phase-II Work execution, Simulation, Testing, Documentation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-I in 5th semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

List of Equipment

INSTRUMENTATION LABORATORY		
Sr	Name of equipment with specification	Quantity per student strength up to 60
1	Conical flask-100ml, 250ml,500 ml	02
2	Volumetric flask-100ml, 250ml	02 no each
3	Burrete-50 ml with complete fitting	02 no each
4	Reagent bottle-250ml	05 no
5	Funnel- different size	02 no
6	Tripod stand	02 no
7	Mortar and pestle	01 no
8	Beaker-250 ml and 500 ml	05 no
9	Pipette- 10 ml, 25 ml	05 no
10	Measuring cylinder-10 ml,50 ml,100 ml	01each
11	Provision of LPG gas heating facility	02 no
12	Separating funnel-500 ml	02 no
13	Digital pH meter	01 no
14	Polarimeter	01 no
15	Refractometer	01 no
16	Laboratory model spectrophotometer	01 no
17	Calorimeter	01 no
18	Different types of pressure gauges, temperature gauge	01 no
19	All small glass ware like glass rod, spatula, watch glass, test tube, test tube holder, dropping bottle etc as per experiment requirement	As per need
20	Digital multimeter	01 no
21	Thermocouple calibration set up	01 no
MASS TRANSFER-2 LABORATORY		
Sr	Name of equipment with specification	Quantity per student strength up to 60
1	Cooling tower set up-laboratory model	01 no
2	Wetted wall column set up-laboratory model	01 no
3	Tray dryer set up-laboratory model	01 no
4	Fluidized bed dryer set up-laboratory model	01 no
5	Open pan crystalliser set up-laboratory model	01 no
6	Swasen walker crystalliser set up-laboratory model	01 no
7	Liquid- liquid extractor set up-laboratory model	01 no
8	Solid-liquid extractor set up-laboratory model	01 no
9	Conical flask-100ml, 250ml,500 ml	02 no
10	Measuring cylinder-10 ml,50 ml,100 ml	01each
11	Provision of LPG gas heating facility	02 no
12	Separating funnel-500 ml	02 no
13	Burrete-50 ml with complete fitting	02 no each
14	Pipette- 10 ml, 25 ml	02 no
15	All small glass ware like glass rod, spatula, watch glass, test tube, test tube holder, dropping bottle etc as per experiment requirement	As per need