DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,BHOPAL

SCHEME OF STUDIES & EXAMINATIONS (IMPLEMENTED FROM SESSION : JULY 2023)

SCHEME	NAME OF BRANCH	BRANCH CODE	SEMESTER
OCBC JULY 2022/2023	CHEMICAL ENGINEERING	C02	THIRD (III)

S.N.	PAPER CODE	SUBJECT CODE	SUBJECT NAME	THEORY COMPONENT								PRACTICAL COMPONENT					TOTAL CREDITS	TOTAL MARKS
				HRS PER WEEK	CREDITS	TERM WORK				THEORY PAPER		HRS PER WEEK	CREDITS	LAB WORK	PRACTICAL EXAM/VIVA			
						QUIZ/ASSIGNMENT	MID TERM TEST*		TOTAL	MARKS	DURATION				MARKS	DURATION		
							I	II										
1	7511	301	INTRODUCTION TO CHEMICAL ENGINEERING	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
2	7512	302	INDUSTRIAL CHEMISTRY	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
3	7513	303	CHEMICAL PROCESS CALCULATIONS	4	4	10	10	10	30	70	03 Hrs.	0	0	0	0	0	4	100
4	7514	304	MOMENTUM TRANSFER	4	4	10	10	10	30	70	03 Hrs.	2	1	20	30	03 Hrs.	5	150
5	7515	305	MECHANICAL OPERATIONS	3	3	10	10	10	30	70	03 Hrs.	4	2	20	30	03 Hrs.	5	150
6	7516	306	ENGINEERING THERMODYNAMICS	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
7			**SUMMER INTERNSHIP- I	0	0	0	0	0	0	0	0	0	2	20	30	03 Hrs.	2	50
8			PROFESSIONAL DEVELOPMENT	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
9			WORKSHOP/SEMINAR/VISIT etc.	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
10			***RECOVERY CLASSES/LIBERARY etc.	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0
TOTAL				20	20				180	420		16	5	60	90		25	750

NOTE - (1)* Two Best, out of Three Mid Term Tests (Progressive Tests) Marks should be entered here.

(2)** 3-4 Weeks Summer Internship after II Semester.

(3)***To recover courses if session delays due to summer internship.

GRAND TOTAL OF CREDITS	GRAND TOTAL OF MARKS
25	750

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DIPLOMA IN CHEMICAL ENGINEERING (C02)

SEMESTER III

COURSE TITLE	:	INTRODUCTION TO CHEMICAL ENGINEERING
PAPER CODE	:	7511
SUBJECT CODE	:	301
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Learning Objectives:

- To give a comprehensive knowledge on various aspects practiced in chemical engineering
- To give the sources of information on related topics.

Course Content:

UNIT I

Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.

UNIT II

Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.

UNIT III

Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipments; Flowsheet representation of process plants,

UNIT IV

Role of Computer in Chemical Engineering; Chemical Engineering Software; Relation between Chemical Engineering and other engineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering: Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc.

UNIT V

Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.

REFERENCE BOOKS:

1. *S. K. Ghosal, S. K., Sanyal and S. Datta, "Introduction to Chemical Engineering", Tata McGraw Hill Education Pvt. Ltd., New Delhi.*
2. *Pushpavanam.S., "Introduction to Chemical Engineering", PHI Learning Pvt. Ltd., New Delhi,*
3. *Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", 6th Edition, Tata McGraw Hill, 1997.*
4. *Dryden, C.E., "Outlines of Chemicals Technology", Edited and Revised by Gopala Rao, M. and M.Sittig, 2nd Edition, Affiliated East-West press, 1993.*

Course Outcomes:

At the end of the course, the student can able to:

- Appreciate various unit operations and processes followed in transforming raw material into value added materials,
- Understand the various representation of flow processes
- Significance of Chemical Engineering to the society in the areas of health, energy, environment and food.

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SEMESTER III

COURSE TITLE	:	INDUSTRIAL CHMISTRY
PAPER CODE	:	7512
SUBJECT CODE	:	302
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

COURSE LEARNING OBJECTIVES:

- To develop the basic knowledge of organic compounds, their preparation, properties and uses.
- To understand the physical principals of chemical systems
- To lay foundation for the understanding other chemical engineering subjects.

COURSE CONTENT:

UNIT-I: Organic Chemistry Nomenclatures of organic compounds, functional groups.

UNIT-II: Classification of organic compounds, aliphatic Compounds, closed chain compounds, unsaturated. Alkanes, alkenes, alkyans, cycloalkanes. Halogenations, saturated halogenation Reaction of alkenes, oxidation, halogenation, Nitration, pyrolysis, isomerisation, dehydrogenation, Structures and reactivity of alkanes, cyclo alkanes. Alkenes, preparation, properties and reactions, Action of ozone, hydrogenation, halogenation, action of halogen acids, sulphuric acid, polymerization, uses of alkenes.

UNIT-III: Aromatic Compounds, alkyl halides, alchohol and phenols. Concept of aromacity, structure of benzene, properties of benzene, reactions of benzene, halogenation, hydrogenation, pyrolysis, Classification of alkyl halides, isomerism in alkyl halides, properties of alkyl halides, substitution reaction, elimination reaction, alcohols. Classification of alcohols, preparation, properties, reaction, phenols Classification, preparation, reaction.

UNIT-IV: Phase rule, Phase rule, phase, component, degrees of freedom, One component system

UNIT -V: Adsorption Definition, nature of adsorption, types of adsorption, Langmuir adsorption isotherm, Freundlich adsorption Isotherm, application, Solutions and Indicators Ideal solution, non-ideal solution, Azeotropic Mixture, and theory of indicators.

REFERENCE BOOKS:

1. *R. T. Morrison, R. N. Boyd and S.K Bhattachrajee, 'Organic Chemistry" Pearson.*
2. *V Raghavan, "Material Science & Engineering" PHI Learning Pvt. Ltd.,*
3. *P.L. Soni and H.M.Chawla, "Text book of organic Chemistry", Sultan Chand & Sons – Tb*
4. *B.R.Puri, L.R.Sharma and M.S.Pathania, "Principles of physical chemistry" Vikas Publishing House Pvt Ltd.,*
5. *K. S.Tewari, S. N Mehrotra, N. K. Vishnoi , "Textbook of organic chemistry" Vikas Publishing House Pvt Ltd.,*

COURSE OUTCOMES:

The student can be able to:

- Write the reactions for given organic compounds.
- Describe reaction for alkanes, alkenes.
- Identify the properties of various organic compounds.
- Compare principles of Langmuir and Freudlich isotherm.
- Describe the mechanism of degree of freedom.

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SEMESTER III

COURSE TITLE	:	CHEMICAL PROCESS CALCULATIONS
PAPER CODE	:	7513
SUBJECT CODE	:	303
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	00

COURSE LEARNING OBJECTIVES

- To give students fundamental knowledge on Unit processes and Unit operations, Units and
- conversions and also the basic laws governing chemical operations.
- To impart knowledge on material and energy balance with and without reactions.

COURSE CONTENT

UNIT-I: Basics of unit operations and unit processes, Units and dimensions.

UNIT-II: Stoichiometric principles – composition relations, density and specific gravity. Behaviour of Ideal gases - application of ideal gas law - gaseous mixtures - volume changes with change in composition.

UNIT-III: Vapour pressure - effect of Temperature on vapour pressure - vapour pressure plots – vapour pressure of immiscible liquids - solutions. Humidity and Solubility: Humidity - saturation -vaporization - wet and dry bulb thermometry.

UNIT-IV: Material Balance - Processes involving chemical reaction - Combustion of coal, fuel gases and sulphur - Recycling operations - bypassing streams - Degree of conversion – excess reactant -limiting reactant. Unsteady state problems

UNIT-V: Energy Balance: Thermo chemistry - Hess's law of summation - heat of formation, reaction, combustion and mixing - mean specific heat - Theoretical Flame Temperature.

REFERENCE BOOKS

1. K.V. Narayanan and B. Lekshmikutty, "Stoichiometry and Process Calculations", Prentice Hall of India Ltd, New Delhi..

2. V.Venkataramani, N.Anantharaman and K.M. Meera Sheriffa Begum, 'Process Calculations' Prentice Hall of India Ltd, New Delhi.

3. B. I. Bhatt, "Stoichiometry", Tata McGraw Hill Publishers Ltd., New Delhi.

4. C. M. Narayanan & B. C Bhattacharya, 'Unit operations and Processes' Vol-I, CBS Publishers & Distributors.

COURSE OUTCOMES

On completion of the course, the students would have,

- The capability to understand the need for study of unit operations and processes. Convert units and dimensions and also modify equations from system to another.
- The capability to apply the laws of physics and chemistry in solving process industry related applications.
- Proficiency to integrate the data and formulate the mass and energy balance problems
- The capability to use mathematical knowledge for solving mass and energy balance problems with and without chemical reactions.

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SEMESTER III

COURSE TITLE	:	MOMENTUM TRANSFER
PAPER CODE	:	7514
SUBJECT CODE	:	304
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	01

COURSE LEARNING OBJECTIVES:

- To impart the fundamental concepts of fluid statics, pressure distribution and dimensional analysis.
- To nurture the students to solve fluid dynamics problems using Newton's laws of motion.
- To enable students to compute velocity profile, friction factor and head loss in pipes and fittings.
- To impart the knowledge of metering and transportation of fluids and fluid moving machinery performance.

COURSE CONTENT:

UNIT-I: Properties of fluids and concept of pressure: Introduction - Nature of fluids - physical properties of fluids - types of fluids. Fluid statics: Pressure - density - height relationships. Pressure measurement. Dimensional analysis. Similarity - forces arising out of physical similarity - dimensionless numbers.

UNIT-II: Momentum Balance and their Applications: Kinematics of fluid flow; Newtonian and non-Newtonian fluids - Reynolds number - experiment and significance - Momentum balance - Forc-es acting on stream tubes - Bernoulli's equation - Correction for fluid friction

UNIT-III: Flow of incompressible fluids in pipes – laminar and turbulent flow through closed conduits - velocity profile & friction factor for smooth and rough pipes - Head loss due to friction in pipes, fitting etc.

UNIT-IV: Flow of Fluids through Solids: Form drag - skin drag - Drag co-efficient. Flow around solids and packed beds. Friction factor for packed beds. Ergun's Equation - Motion of particles through fluids - Terminal settling velocity. Fluidisation - Mechanism, types, general properties – applications

UNIT-V: Transportation and Metering: Measurement of fluid flow: Orifice meter, Venturi meter, Pitot tube, Rotameter, weirs and notches Wet gas meter and dry gas meter. Hot wire and hot film anemometers. Transportation of fluids: Fluid moving machinery performance. Selection and specification. Positive displacement pumps, Rotary and Reciprocating pumps, Centrifugal pumps and characteristics, Introduction to Fans, Blowers & Compressors

REFERENCE BOOKS

1. A. K. Mohanty, "Fluid Mechanics", Prentice Hall of India Ltd, New Delhi.

2. W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering",

McGraw Hill, International Edn.,

3. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol 1, Butterworth Heinemann.

4. C. M. Narayanan & B. C Bhattacharya, 'Unit operations and Processes' Vol-I, CBS Publishers & Distributors.

COURSE OUTCOMES

On completion of the course, the students would have,

- The knowledge of fundamental concepts in fluids statics and to use dimensional analysis for scaling experimental results
- The ability to solve hydrostatic and fluid flow problems using Newton's laws of motion
- The ability to analyze frictional flow in pipes and piping networks and to compute the head loss and power requirements for chemical process equipments.
- The ability to select the metering equipments and fluid moving machinery for appropriate chemical engineering operations.

MOMENTUM TRANSFER LAB

COURSE LEARNING OBJECTIVES:

Understand and application of the principles & concepts of learned in momentum transfer theory course

CONTENTS:

To conduct experiment to study

1. Different types of manometers
2. Major losses in pipe flow
3. Minor Losses (Globe Valve, Bends and Elbows)
4. Major losses in spiral coil flow
5. Major losses in helical coil flow
6. Flow Through Packed Bed
7. Flow Through Fluidized Bed
8. Calibration of orifice meter
9. Calibration of venturi meter
10. Calibration of pitot tube
11. Calibration of channel
12. Characteristics of reciprocating pump
13. Characteristics of centrifugal pump

REFERENCES:

1. Lab Manual
2. *W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.*
3. *G Chandrasekhar, Laboratory Experiments in Chemical and Allied Engineering, Penram International Publishing (India) Pvt. Ltd.*

COURSE OUTCOME:

After completion of the course, student can able to

- Understand and application of the concept of manometers
- Understand and analyse the laminar and turbulent flow
- Understand, apply and analyse the friction factor
- Understand the concepts of flow meters, pumps.

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SEMESTER III

COURSE TITLE	:	MECHANICAL OPERATIONS
PAPER CODE	:	7515
SUBJECT CODE	:	305
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	02

COURSE LEARNING OBJECTIVES:

To impart knowledge on

- Understand basic principles of particle preparation and their characterization
- Understand the performance of different equipments for separation of solids and size reduction
- Basic principles in various operations such as Size Reduction, Filtration, Sedimentation, Mixing and Agitation etc.
- Study various methods for storage of solids and conveyors available for their transportation.

COURSE CONTENT:

UNIT-I: Characteristics of Particulate Material: Properties and characterisation of particulate solids, Flow properties of particulates.

UNIT-II: Introduction to size reduction equipment, energy and power requirement in milling operations

UNIT-III: Separation of solids, Solid – Solid Separation Equipments

UNIT-IV: Particulate Processes: Solid-Liquid and Gas-Solid separation methods, Equipments Classification by size, agitation and mixing of solids and liquids,

UNIT- V: Handling of Particulate Material: Conveying methods, Storage methods, Feeders and elevators.

REFERENCE BOOKS

1. Anup. K.Swain, Hemlata Patra, G.K.Roy., "Mechanical Operations", McGraw Hill Education.

2. McCabe and J.C.Smith," Unit Operation of Chemical Engineering", McGraw Hill., New York.

3. M. Coulson and J.F. Richardson, "Chemical Engineering", Vol. II, Butterworth- Heinemann.

4. Badger and Banchero, "Introduction to Chemical Engineering", McGraw Hill, New York.

COURSE OUTCOMES

On completion of the course, students are expected to

- understand the basic principles of particles preparation and their characterization.
- have knowledge about different size reducing equipment and power requirements during size reduction.
- have an understanding on solid fluid separation equipment.
- have an understanding of solid storage and their conveying in chemical process industries.

MECHANICAL OPERATIONS LAB

COURSE LEARNING OBJECTIVES:

- To impart hands on experience on different unit operation equipments.
- Apply principles developed in chemical engineering courses to the analysis of chemical engineering processes and unit operations.

CONTENTS:

1. Different types of density of particle (Bulk, Particle, Repose)
2. Angle of repose
3. Particle size distribution
4. Screen effectiveness
5. Jaw crusher
6. Ball mill
7. Drop weight crushes
8. Drag studies
9. Settling studies
10. Separation of solids using settling characteristics
11. Constant Pressure Filtration
12. Constant Volume Filtration
13. Elutriation
14. Agitated vessel
15. Storage of Solids

REFERENCES:

1. Lab Manual
2. *W. L. McCabe, J.C. Smith and P. Harriott, "Unit operations of Chemical Engineering", McGraw Hill, International Edn.,*
3. *G Chandrasekhar, Laboratory Experiments in Chemical and Allied Engineering, Penram International Publishing (India) Pvt. Ltd.,*

COURSE OUTCOME:

After completion of the course, student can able to:-

- Understand the fundamentals involved in the Mechanical operations.
- understand and application of the concept of Particulate properties and its measurements.
- understand liquid-solid and gas-solid separations.

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SEMESTER III

COURSE TITLE	:	ENGINEERING THERMODYNAMICS
PAPER CODE	:	7516
SUBJECT CODE	:	306
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

COURSE LEARNING OBJECTIVES:

To impart knowledge on

- To understand the basic knowledge of thermodynamic systems used in Chemical Engineering operations.
- To understand basic working principles of boilers.
- To understand the Energy conservation opportunities in steam systems

COURSE CONTENT:

UNIT-I: Basic Concepts and Definitions: Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics.

UNIT-II: First Law of Thermodynamics: The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases

UNIT-III: Second Law of Thermodynamics: Equilibrium and the second law - Heat engines - Kelvin-Planck statement - Reversible and irreversible processes - Carnot principle - Clausius inequality-Entropy –Third Law of Thermodynamics

UNIT-IV: Gas Power Cycles: Air standard cycles: - Air standard Otto cycle, diesel cycle, dual cycle and Bryton cycles and their efficiencies

UNIT-V: Refrigeration Cycles and Systems: Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system (only theory)- Liquification and solidification of gases

REFERENCE BOOKS

1. Nag, P. K., "Engineering Thermodynamics", Tata McGraw Hill Publishing Co. Ltd., New Delhi.

2. Arora, C.P., "Thermodynamics", Tata McGraw Hill Publishing Co. Ltd., New Delhi.

COURSE OUTCOMES

On completion of the course, the students will be able to

- understand the conceptual laws of thermodynamics for application in thermodynamic cycles.
- understand and analyze different thermodynamic cycles and calculate their thermal efficiencies.
- understand the basics of boilers and perform simple calculations of boiler efficiencies.
- understand the steam distribution and utilization systems to identify the energy conservation opportunities.
- comprehend principles of steam turbines and calculation of turbine efficiencies; understand the basics of vacuum pumps and instruments for measurement of vacuum.

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SEMESTER III

COURSE TITLE	:	SUMMER INTERNSHIP - I
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	02

SUMMER INTERNSHIP –

3-4 weeks summer internship after IInd Semester.

It should be undertaken in an industry/Govt. or Pvt. Certified Agencies which are in social sector/Govt. Skill Centers/Schemes.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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SEMESTER - III

COURSE TITLE	:	PROFESSIONAL DEVELOPMENT
PAPER CODE	:	--
COURSE CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	00

Course Objectives:

Following are the objectives of this course:-

(1) To learn the principles of Professional and Social ethics.
(2) To know the concept of Lifelong learning and Self-directed learning.
(3) To present self for employment.
(4) To introduce the need of industrial visits.
(5) To understand CV, Resume, Bio-data and Interview and their significance.
(6) To develop the skills of Group Discussion.

Course Content:

Unit – I Professional and Social Ethics

Professional ethics, its need and importance, general code of ethics for engineers, ethical issues for engineers.

Need and importance of social skills, social skills for better group performance, important social skills such as social perceptiveness, coordination, negotiation, persuasion etc.

Unit – II Lifelong learning and Self-directed Learning

Lifelong learning, its examples, self-directed learning, its examples, important steps in lifelong learning.

Need for planning self-directed learning, planning self-directed learning plan, examples.

Unit – III Career Planning

Importance of career planning, major career opportunities in concerned branch of engineering , study of the important career opportunities regarding qualification, knowledge, skills, experience required for them, role of personal factors like personal life style, interest areas, desires, personal preferences in career planning.

Identification and detailing of important career opportunities in relation to branch of diploma, identification and detailing of important self-personal factors and self-personal preferences, development of self-career plan.

Unit – IV Industrial Visits

Necessity of exposure to environment and practices, lectures by industry experts.

Importance of Students' industrial visits, learning through observing real life industrial systems, planning and organizing the industrial visits.

Unit – V CV, Resume, Bio-data and Interview

Need of presenting self for employment, salient features and formats of bio-data, CV, resume, comparison of the three for their merits, limitations and specific uses, study of cases and examples of bio-data, CV, resume and covering letter by all students for self of for the given cases.

Importance of employment related interviews, purpose of interview, dress code, body language and posture of interviewee, do's and don'ts for interviews, interview checklist, practice of facing employment related interviews for all students.

Unit – VI Group Discussion

Need and importance of group discussion in professional work, ideal group discussion and skills needed to effectively participate in group discussion, practice of group discussion skills.

Course Outcomes:

After completing this course, the student will be able to:-

(1) Demonstrate his/her understanding of Professional and Social ethics.
(2) Plan self-learning and self-directed learning for completing the task.
(3) Suggest an action plan for his career planning.
(4) Demonstrate his/her learning from visits to industry.
(5) Prepare CV, Resume and Bio-data along with a covering letter for a job.
(6) Effectively face an interview.
(7) Participate in Group discussion.

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