DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA , BHOPAL

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

SCHEME	NAME OF BRANCH	BRANCH CODE	SEMESTER
OCBC JULY2022/ 2023	CHEMICAL ENGINEERING	C02	FOURTH (IV)

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	7517	401	PROCESS HEAT TRANSFER	4	4	10	10	10	30	70	03 Hrs.	2	1	20	30	03 Hrs.	5	150
2	7518	402	MASS TRANSFER - I	4	4	10	10	10	30	70	03 Hrs.	0	0	0	0	0	4	100
3	7519	403	CHEMICAL ENGINEERING THERMODYNAMICS	4	4	10	10	10	30	70	03 Hrs.	0	0	0	0	0	4	100
4	7520	404	CHEMICAL TECHNOLOGY	4	4	10	10	10	30	70	03 Hrs.	0	0	0	0	0	4	100
5	7521	411	PETROLEUM REFINING AND PETROCHEMICAL TECHNOLOGY OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7522	412	PETROLEUM ENGINEERING															
6			CHEMICAL ENGINEERING DRAWING	0	0	0	0	0	0	0	0	6	3	20	30	03 Hrs.	3	50
7			MINOR PROJECT	0	0	0	0	0	0	0	0	4	2	20	30	03 Hrs.	2	50
8			ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9			LIBERARY /SEMINAR/VISITS etc.	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
TOTAL				21	19				150	350		15	6	60	90		25	650

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

GRAND TOTAL OF CREDITS	GRAND TOTAL OF MARKS
25	650

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DIPLOMA IN CHEMICAL ENGINEERING (C02)

SEMESTER IV

COURSE TITLE	:	PROCESS HEAT TRANSFER
PAPER CODE	:	7517
SUBJECT CODE	:	401
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	01

COURSE LEARNING OBJECTIVES:

- To study the fundamental concepts of heat transfer viz., conduction, convection, radiation, Boiling and Condensation.
- To use these fundamentals in typical engineering applications (Heat exchanger and Evaporator) and current research.

COURSE CONTENT:

UNIT-I: Basic modes of heat transfer and the laws governing them. Steady state conduction through plane and composite walls general heat conduction equation, concepts of thermal diffusivity and equivalent thermal conductivity.

UNIT-II: Convection – Dimensional analysis and empirical correlations, Critical insulation thickness for cylindrical and spherical surfaces, Physical significance of the dimensionless groups.

UNIT-III: Thermal Radiation laws, spectrum of electromagnetic radiation, Black and Gray bodies and configuration factor – typical examples. Boiling and condensation.

UNIT-IV: Heat Exchangers – classification, overall and individual film coefficients, mean temperature difference, LMTD correction factor for multiple pass exchanger

UNIT-V: Evaporation, single and multiple effect operation, material and Energy balance in evaporators, boiling point elevation, Duhring's rule, effect of liquid head.

REFERENCE BOOKS:

1. DC. Sikdar, "Process Heat Transfer and Chemical Equipment Design", Revised Ed., Khanna Publishing House

2. W. L. McCabe and J. C. Smith, "Unit Operations In Chemical Engineering", 7th Edn.,McGraw Hill Publishing Co.

3. Binay K. Dutta, "Heat Transfer Principles and applications" Prentice Hall of India Pvt. Ltd.

4. C. M. Narayanan & B. C Bhattacharya, 'Unit operations and Processes' Vol-I, CBS Publishers & Distributors, 2006

COURSE OUTCOMES:

On completion of the course, the student can able

- to estimate steady state heat transfer rates from/to objects
- to use equations for different types of convection and solve for heat transfer rate by convection
- to estimate the rate of radiation heat transfer with and without participating medium, ability to identify the roll of re-radiating surface, radiation shields, boiling and condensation.
- to estimate steam economy, capacity of single and multiple effect evaporators.

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PROCESS HEAT TRANSFER LAB

COURSE LEARNING OBJECTIVES:

To provide experience on testing, and analysis of heat transfer equipments in various approaches.

COURSE CONTENT

- Temperature distribution in a metal rod
- Thermal Conductivity of metal rod
- Radiation
- Natural convective heat transfer
- Forced convective heat transfer
- Double pipe heat exchanger
- Shell and Tube Heat exchanger
- Plate Heat Exchanger
- Condenser
- Heat Transfer in Jacketed Kettle
- Open pan evaporator

REFERENCE BOOKS

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 OUTCOMES

The students have understood how heat transfer occurs for different equipments and worked out the parameters studied in theory.

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SEMESTER IV

COURSE TITLE	:	MASS TRANSFER - I
PAPER CODE	:	7518
SUBJECT CODE	:	402
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	00

COURSE LEARNING OBJECTIVES:

- To learn the concept of diffusion in gas, liquid & solid.
- To understand the basics of interphase mass transfer.
- To learn application of gas-liquid operation and simultaneous heat and mass transfer
- operations.

COURSE CONTENT:

UNIT-I: Definition- Ficks law, Molecular and eddy diffusion, Diffusion in gaseous mixtures, liquid mixtures and solids, measurement and calculation of diffusivities. Mass transfer coefficients - Individual and overall with relations, Theories of mass transfer, Analogies between momentum, heat and mass transfer to predict mass transfer coefficients.

UNIT-II: Absorption – Solubility, theory of gas absorption, Concept of Equilibrium and operating lines. Mass Transfer Equipments- Batch and continuous, Stage wise contactors and Differential contactors, Concept of HTU and NTU, Tower packings and packing characteristics,

UNIT-III: Humidification Theory, Psychometric Chart, Adiabatic Saturator, Wet Bulb Theory, Methods of Humidification and dehumidification, Cooling towers,

UNIT-IV: Drying Theory and Mechanism, Drying Characteristics, Estimation of Drying time, drying rate curve, Classification of Driers, Description and Application of Driers, Continuous driers.

UNIT-V: Crystallization, Solubility curve, Types of crystals, Principles of Crystallization, Supersaturation Theory, Factors governing nucleation and crystal growth. Theory of crystallization, Classification of crystallizers and their applications.

REFERENCE BOOKS:

1. Binay. K.Dutta " Principles of Mass Transfer and Separation Processes"., PHI Learning

2. R.E. Treybal, "Mass Transfer Operations", McGraw Hill Book Co., New York.

3. N. Anantharaman and K.M.Meera Sheriffa Begum, "Mass Transfer Theory and Practice", Printice Hall of India Pvt. Ltd., New Delhi.

4. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol. II, Butterworth Heinemann, New York.

5. W.L. McCabe, J.C. Smith and P. Harriot, "Unit Operations of Chemical Engineering", McGraw Hill Book Co., New York.

COURSE OUTCOMES:

On completion of the course, the student will be:

- familiar with the basic phenomenon of mass transfer involving phases.
- able to apply the concepts of mass transfer in gas-liquid systems like absorption, humidification, drying and crystallization
- Gaining good knowledge of required optimum condition for a gas-liquid system.

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SEMESTER IV

COURSE TITLE	:	CHEMICAL ENGINEERING THERMODYNAMICS
PAPER CODE	:	7519
SUBJECT CODE	:	403
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	00

COURSE LEARNING OBJECTIVES:

This course will impart

- knowledge on the concepts of thermodynamics.
- Use of thermodynamics concepts in chemical engineering applications and
- Appreciate the relationship between thermodynamics with separation and reactions.

COURSE CONTENT:

UNIT-I: Introduction to Basic laws and Terminologies in Thermodynamics- Statement of First law, P-V-T behavior of pure fluids - Heat effects accompanying chemical Reactions - Statements of second law- Clausius Inequality-Mathematical Statement of Second law-Third Law of Thermodynamics.

UNIT-II: Applications to Laws of Thermodynamics - Flow processes: Flow in pipes, Flow through nozzles, Compression- Refrigeration

UNIT-III: Thermodynamic Properties of Pure Fluids- Classification of Thermodynamic properties –Work function and Gibb's Free energy-Fundamental Property relations-Maxwell's equations Clapy-eron equation- -Differential equations of Entropy Relationship between Cp and Cv-Effect of pressure and volume on Cp and Cv- Gibb's Helmholtz Equation

UNIT-IV: Thermodynamic Properties of Solutions - Introduction to fugacity and activity, Activity co-efficients-Partial molar properties- Lewis Randall rule-Roults and Henry's law-Gibbs Duhem Equa-tion

UNIT-V: Phase Equilibria and Chemical Reaction Equilibria - Criteria for phase equilibrium, Criterion of stability, Phase equilibria in single and multiple component systems, Duhem's theorem, VLE for Ideal solutions, Reaction stoichiometry-Equilibrium constant- Feasibility of reaction- Effect of tem-perature, pressure, volume and other factors

REFERENCE BOOKS:

2. J.M. Smith, Hendrick Van Ness, Michael M. Abbott, Introduction to Engineering Thermodynamics, McGraw Hill, New York.

3. K.V.Narayanan, A Textbook of Chemical Engineering Thermodynamics, PHI Learning, New Delhi.

4. S. Sundaram, Chemical Engineering Thermodynamics, Ahuja Publishers, New Delhi.

COURSE OUTCOMES:

- On completion of the course, the students will be familiar with,
- Fundamentals of thermodynamics as applied to various processes
- Thermodynamics Properties as applied to ideal and real gases
- Determination of equilibrium states for mixture of gases, phases and chemical reaction
- Relationship between thermodynamics, separations and reactions.

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DIPLOMA IN CHEMICAL ENGINEERING (C02)

SEMESTER IV

COURSE TITLE	:	CHEMICAL TECHNOLOGY
PAPER CODE	:	7520
SUBJECT CODE	:	404
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	00

COURSE LEARNING OBJECTIVES:

- To impart the basic concepts of chemical technology.
- To develop understanding about unit process and unit operations in various industries.
- To learn manufacturing processes of organic and Inorganic Chemicals and its applications and major engineering problems encountered in the process.
- To learn the process flow sheet drawing for the manufacturing chemical processes.

COURSE CONTENT:

UNIT-I: Natural Products Processing: Production of pulp, paper and rayon, Manufacture of sugar, starch and starch derivatives, Gasification of coal and chemicals from coal.

UNIT-II: Industrial Microbial Processes and Edible Oils: Fermentation processes for the production of ethyl alcohol, citric acid and antibiotics, Refining of edible oils and fats, fatty acids, Soaps and detergents.

UNIT-III: Alkalies and Acids: Chlor - alkali Industries: Manufacture of Soda ash, Manufacture of caustic soda and chlorine - common salt. Sulphur and Sulphuric acid: Mining of sulphur and manufacture of sulphuric acid. Manufacture of hydrochloric acid.

UNIT-IV: Cement Gases, Water and Paints: Types and Manufacture of Portland cement, Glass: Industrial gases: Carbon dioxide, Nitrogen, Hydrogen, Oxygen and Acetylene - Manufacture of paints - Pigments

UNIT-V: Fertilisers: Nitrogen Fertilisers; Synthetic ammonia, nitric acid, Urea, Phosphorous Fertilisers: Phosphate rock, phosphoric acid, super phosphate and Triple Super phosphate

REFERENCE BOOKS:

1. R. Gopal and M. Sittig, " Dryden's Outlines of Chemical Technology: For The 21st Century" Third Edition, Affiliated East-West Publishers.

2. G.T. Austin, "Shreve's Chemical Process Industries", McGraw Hill, NewYork.

3. O.P. Gupta, "Chemical Process Technology", Khanna Publishing House

4. W.V.Mark, S.C. Bhatia "Chemical Process Industries volume I and II" CBS Publishers & Distributors

5. S. D. Shukla and G. N. Pandey, "Text book of Chemical Technology" Vol 2, Vikash Publishing Company.

COURSE OUTCOMES:

On completion of the course, the student can be able to

- Understand the various unit operations and processes with their symbols
- Understand the manufacturing process of natural products processing and industrial microbial processes and edible oils.
- Understand the various chemical reactions involved in the process
- Understand the manufacturing process of inorganic chemicals
- Draw the process flow sheet and understand the major engineering problems encountered in the processes.

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DIPLOMA IN CHEMICAL ENGINEERING (C02)

SEMESTER IV

COURSE TITLE	:	PETROLEUM REFINING AND PETROCHEMICAL TECHNOLOGY
PAPER CODE	:	7521
SUBJECT CODE	:	411
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

COURSE LEARNING OBJECTIVES:

- To impart introductory knowledge of petroleum refining and corresponding processes.
- To provide an insight into petrochemical industry.

COURSE CONTENT:

UNIT-I: Introduction & primary processing: Origin & formation of crude oil, Classification of crude, Characterization of crude, Distillation practise, Atmospheric distillation, Vacuum distillation.

UNIT-II: Secondary Processing: FCCU, Hydro cracking, Visbreaking, Coking, Reforming, Alkylation, Isomerisation and polymerization processes.

UNIT-III: Treatment Techniques: Physical & chemical impurities in petroleum fractions, General mechanisms for removal of Sulphur, Treatment of LPG, Gasoline, Kerosene, Diesel and Lube oils. Properties of ATF and Bitumen.

UNIT-IV: Petrochemical: Building blocks, intermediates, major petrochemicals and their applications,

UNIT-V: Chemicals from methane and synthesis gas, Chemicals from olefins, Chemicals from aromatics, Synthetic fibres, plastics and rubber.

REFERENCE BOOKS

1. *B.K. Bhaskarao, Bulk Chemicals from Petroleum, Khanna Publishing House*
2. *B. K. Bhaskara, "Modern Petroleum Refining Processes", Oxford and IBH*

Publishing Company, New Delhi.

3. *W.L. Nelson, "Petroleum Refinery Engineering", McGraw Hill, New York.*
4. *O.P. Gupta, "Elements of Petroleum Refinery Engineering", Khanna Publishing House*
5. *Saikat Maitra & O.P. Gupta, "Elements of Petrochemical Engineering", Khanna Publishing House, New Delhi*

COURSE OUTCOMES

- On completion of the course, the students will be able to develop overview of petroleum industry and know about origin, formation composition and characterization of crude oil.
- Comprehend primary processing mechanisms of crude to obtain various petroleum cuts.
- Know about secondary conversion techniques and treatment processes in petroleum refinery to get products of desired yield and quality
- Understand manufacturing processes and applications of various petrochemicals
- Grasp environmental and safety aspects in petroleum refinery and petrochemical industries.

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SEMESTER IV

COURSE TITLE	:	PETROLEUM ENGINEERING
PAPER CODE	:	7522
SUBJECT CODE	:	412
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

COURSE LEARNING OBJECTIVES:

To provide

- an overview of petroleum industry.
- Petroleum exploration and exploitation techniques,
- oil and gas reserve identification and evaluation.
- Drilling and production of oil and gas. Disposal of effluents.

COURSE CONTENT:

UNIT-I: Earth science - occurrence of petroleum Rocks and traps. Reservoir rocks and properties. Classification of oil and gas reserves Reservoir mechanics and drive mechanism.

UNIT-II: Drilling – introduction to drilling of oil and gas wells. Drilling rigs and equipments. Drilling fluids and cementing.

UNIT-III: Logging techniques. Various types of logs. Formation parameters. Log applications. Formation evaluation. Well completion.

UNIT-IV: Petroleum exploration – well testing, production potential and well performances. Material balance, Artificial lift, Improved recovery methods.

UNIT-V: Surface equipments, processing of oil and gas. Transportation of oil and gas. Effluent treatment. Petroleum economics. Supply and demand trends.

REFERENCE BOOKS:

1. *Geology of Petroleum by Leverson A.L.- 2nd edition The AAPG foundation.*
2. *Principles of oil production by T.E.W Nind- 2nd edition Mc Graw-Hill.*
3. *Introduction to Petroleum Engineering by Geltin*
4. *Vikas Mahto, Objective Questions & Answers in Petroleum Engineering, Khanna Publishing House, New Delhi*
5. *Wellsite Geological Techniques for petroleum exploration, Oxford and IBH publishing Company.*

COURSE OUTCOMES

After completing the course, a student can able to understand the various processes involved in the upstream processes of petroleum Engineering.

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SEMESTER IV

COURSE TITLE	:	CHEMICAL ENGINEERING DRAWING
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	03

COURSE LEARNING OBJECTIVES:

To develop skill to design and install process equipments used widely in the chemical industry.

COURSE CONTENT:

UNIT-I: P & ID symbols – Line numbering – line scheduling – Typical P & ID diagrams, Different types of valves, Pumps, Gland & Stuffing box

UNIT-II: Drawing of vessels & supports such as bracket, saddle, skirt.

UNIT-III: Storage Tanks, Cyclone separators centrifuges, thickeners and filtration equipments.

UNIT-IV: Crystallizers, agitated vessel, jacketed and coil heated vessels.

UNIT-V: Double Pipe & Shell & Tube Heat Exchangers, Tray Columns & Packed Columns

REFERENCE BOOKS:

1. *D.C. Sikdar, "Process Heat Transfer & Chemical Equipment Design", Revised Ed. Khanna Publishing House*
2. *V. V.Mahajani and S. B. Umarjii, "Joshi's Process Equipment Design", Mac Millan Publishers India Limited, New Delhi,*
3. *R. K. Sinnott, "Chemical Engineering Design", Coulson and Richardson's Chemical Engineering Series, Volume-6, Fourth Edition, Butterwoth-Heinemann, Elsevier, NewDelhi, 2005.*
4. *R. H. Perry, "Chemical Engineers' Handbook", 7th Edn., McGraw Hill , NewYork, 1998.*
5. *B.C. Bhattacharyya, "Introduction to Chemical Equipment Design Mechanical Aspects", CBS Publishers & Distributors, New Delhi.*

COURSE OUTCOMES:

On completion of the course, the student can be able to

- Identify different components of vessels
- Draw the components of vessels
- Draw the mechanical operation of equipments
- Draw the heat transfer equipments and
- Draw the packed and tray columns

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DIPLOMA IN CHEMICAL ENGINEERING (C02)

SEMESTER - IV

COURSE TITLE	:	MINOR PROJECT
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	02

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

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SEMESTER - IV

COURSE TITLE	:	ESSENCE OF INDIAN KNOWLEDGE AND TRADITION
PAPER CODE	:	--
COURSE CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	00

Course Content:

Basic Structure of Indian Knowledge System:

(i) वेद, (ii) उन्नवेद (आयवेद, धनुवेद गन्धवेद स्थान्त्य आदद) (iii) वेदांग (शिक्षा कल्न ननरूत व्याकरण ज्योनतष छांद),

(iv) उन्नाइग (धर्म रीरांसा, नुराण, तकमिस्त्र)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

SUGGESTED TEXT/REFERENCE BOOKS:

S. No.	Title of Book	Author	Publication
1.	Cultural Heritage of India-Course Material	V. Sivaramakrishna	Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2.	Modern Physics and Vedant	Swami Jitatmanand	Bharatiya Vidya Bhavan
3.	The wave of Life	Fritzof Capra	
4.	Tao of Physics	Fritzof Capra	
5.	Tarkasangraha of Annam Bhatta, Inernational	V N Jha	Chinmay Foundation, Velliarnad, Amaku,am
6.	Science of Consciousness Psychotherapy and Yoga Practices	RN Jha	Vidyanidhi Prakasham, Delhi, 2016

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