Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **VI**
Subject: **Mass Transfer-I** Code: **C019611(019)**
Periods per week (L-T-P): **(3-1-0) / Week** Credits: **04**
Number of Class Test to be conducted**: 02 (Minimum)**
No. of assignment to be submitted: **05**
Scheme of Examination (Theory): **Total Marks-150[ESE-100, CT-20, TA-30]**

PREREQUISITES: Knowledge of Fluid Mechanics, Chemical Engineering Thermodynamics, Chemical Reaction Engineering, Engineering Mathematics, Physics and Chemistry.

COURSE OBJECTIVES:

1. The general objectives of Separation Process-I are to discuss the fundamental concepts of Mass Transfer principles to apply those concepts to real engineering problems.
2. This course will provide an overview of Mass Transfer Operations at basic to an intermediate level.
3. This course will applies the concepts of diffusion mass transfer, mass transfer coefficient, convective mass transfer, inter-phase mass transfer, equipments for gas liquid operations, absorption and distillation.

COURSE DETAILS:

Unit 1: **(08 hrs)**
Diffusion – Fick's law of Diffusion, steady state molecular diffusion in fluid under stagnant Laminar conditions, Diffusion through variable cross sectional area, Diffusion coefficient measurement and prediction, Measurement of liquid phase diffusion coefficient, Multi-component diffusion, Diffusivity in solids and it's applications.

Unit 2: **(08 hrs)**
Mass Transfer Coefficient: Individual and over all mass transfer coefficient, Inter-phase Mass Transfer Theory, Penetration Theory, Boundary Layer Theory, Reynolds, Prandtl and Taylor Analogy, Mass Transfer with Chemical Reaction.

Unit 3: **(08 hrs)**
Distillation: Introduction to distillation, Raoult's law, Relative volatility, Vapor liquid equilibrium (VLE), Boiling point diagram, Partial vaporization and condensation, Flash and Differential distillation for binary mixtures, Steam distillation, Azeotropes and Extractive distillation.

Unit 4: **(08 hrs)**
Continuous distillation with rectification, Calculation of Number of plates - Lewis Sorel Method, McCabe Thiele Method, Reflux Ratio-Optimum and Minimum Reflux Ratio, Underwood Fens key Equation, Plate efficiency, Enthalpy - Concentration diagram.

Unit 5: **(08 hrs)**
Absorption: Introduction to absorption, Henery's Law, Design of packed absorption tower based on over all mass transfer coefficient, Counter current multistage, absorption, Continuous contact equipments.

On completion of each unit, students' has to submit one assignment from every unit.

COURSE OUTCOMES:

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

CO1. Interpret and demonstrate the fundamentals with application of diffusion theory capably.
CO2. Define and establish the significance of mass transfer coefficient and overall mass transfer coefficient in correlation to different theories and analogy.
CO3. Determine, explain and apply the principles of distillation significantly.
CO4. Illustrate and solve the intricate problems of different distillation operations efficiently.
CO5. Exemplify and make useful solution ofthe complex problems of absorption principles and theories.
CO6. Demonstrate and elucidate the complicated calculations of diffusion, distillation and absorption tower.

Text Books:

1. Treybal, R.E., "Mass Transfer Operations", McGraw –Hill International Edition, 3rd Ed., 1998
2. McCabe, W.L., Smith, J. and Harriot, P., "Unit Operation of Chemical Engineering", McGraw-Hill International Edition, 6th Ed., 2001

References Books:

1. Geankoplis, C.J., " Transport Process and Unit Operations", Prentice Hall, 3rd Ed., India, 1993.
2. Badger, W.L., Banchero, J.T. "Introduction to Chemical Engineering", Tata McGraw Hills Publishing Company Limited , 3rd Ed., 1997

OPEN SOURCE LEARNING:

http://nptel.ac.in/
http://ocw.mit.edu/courses/chemicalengineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: Chemical **Engineering** Semester:**VI**
Subject: **Transport Phenomena** Code: **C019612(019)**
Periods per week (L-T-P):**(3-1-0)** Credits:**04**
Number of class Test to be conducted**:2(Minimum)**
No.ofassignmenttobesubmitted:**05**
Scheme of Examination (Theory):**TotalMarks-150[ESE-100,CT-20,TA-30]**

PREREQUISITES: Knowledge of Fluid mechanics. Heat and Mass Transfer

COURSE OBJECTIVES:

1.The course will acquaint the students with topics in transport phenomena (momentum, heat and mass transport).
2.The Focus will be to develop physical understanding of principles discussed and with emphasis on chemical engineering applications. In addition to the text, the student will be exposed to classic and current literature in the field.
3.To provide basic understanding of laws governing transport processes and effect of various parameters.
4.To deal with equations of change and analogies amongst transport processes along with their applications

COURSEDETAILS:

UNIT- I Introduction to transport phenomena: General Molecular Transport Equations, Molecular Heat Equation, Molecular Momentum Equation, Molecular Mass Equation, Newtonian and non-Newtonian Fluids. Falling Film in Laminar Flow, Flow through Circular Tubes, Annulus and Rectangular Duct, Adjacent flow of Immiscible Liquids between two Parallel plates, Couette Flow (**10 hrs)**

UNIT- II Equation of continuity and motion: Momentum balance - boundary conditions - application of shell balance to simple flow systems Equation of Continuity, Rectangular, Cylindrical & Spherical Co-ordinates, Equation of Motion, Use of Equations of Continuity & Motion, Tangential Annular Flow, Shape of Cylindrical Surface, Vortex Depth (**08 hrs)**

UNIT- III Introduction to heat transport: Shell energy balance, Boundary conditions - application of shell balance to heat conduction problems - conduction– Fourier's Law of heat conduction, temperature and pressure Dependence of thermal conductivity of gases and liquids, thermal conductivity of Solid (**08 hrs)**

UNIT- IV Heat Transport through various sources: Heat Transport through Composite wall, through composite Cylinder with electrical Heat Source, with Nuclear Heat Source, Due to Viscous Dissipation through Fin, Convection heat transfer co-efficient. (**06 hrs)**

UNIT- V Introduction to mass transport: Shell mass balance - boundary conditions , diffusivity and mechanism of mass transform, diffusion in gases at low density , diffusion in liquids , diffusion through spherical film, diffusion in liquid , mass transfer with chemical reaction. (**08 hrs)**

COURSE OUTCOMES:

After completing the course, students will be able to

CO1. Set up and solve differential momentum, heat and mass balances for 1-D steady state problems and quasi-steady-state problems occurring in laminar and turbulent flows in terms of vector and tensor fluxes.

CO2. Identify and develop different models and similarity studies for scale up methods.

CO3. Explain and compare the different concepts of regime in scale up studies.
CO4. Formulate conservation statements in heat, mass, and momentum at multi scales from microscopic to macroscopic in both steady and unsteady modes.

CO5. Analyse advanced transport problems in heat, mass, and momentum, both macroscopic and microscopic formulate simultaneous energy and mass balances in chemical processes.

Text Books:
1. R.B. Bird, W.E. Stewart and E. W. Lighfoot, "Transport Phenomena", John Wiley & Sons.
2. Brodkey, R. S. and Hershey, H. C., "Transport Phenomena", McGraw-Hill
3. Welty, J.R., Wicks, C.W., Wilson, R.E. and Rorrer, G., "Fundamentals of Momentum Heat and Mass Transfer", John Wiley & Sons

Reference books:

1. C. J. Geankopolis, Transport Processes in Chemical Operations, 3rd Ed., Prentice Hall of India, New Delhi, 1996.

OPENSOURCELEAENING:

http://nptel.ac.in/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering**
Subject: **Process Equipment Design-II**
Periods per week (L-T-P):**(3-1-0)**
Number of class Test to be conducted: **2 (Minimum)**
Scheme of Examination (Theory):**Total Marks- 150 [ESE-100, CT-20,TA-30]**

Semester: **VI**
Code: **C019613(019)**
Credits: **04**
No. of assignment to be submitted:**03**

PREREQUISITES: Knowledge of Engineering Mathematics and Heat Transfer Operations.

COURSE OBJECTIVES:

1. To understand the design parameters of various types of heat exchangers, condensers and evaporators used in chemical plants.
2. To learn the key concepts and techniques with relevant codes and standard procedures applicable to design heat transfer equipments.
3. To study and apply standard codes for design of parallel counter flow double pipe heat exchangers, 1-2 parallel counter flow shell and tube heat exchangers including heaters, coolers, horizontal and vertical condensers and single and multiple effect evaporators

COURSE DETAILS:

UNIT I: Double Pipe Heat Exchanger
Counter flow type double pipe heat exchangers in series-parallel arrangement, Concept of equivalent diameter,
Equivalent diameters in tube and annulus, Film coefficients for fluids in pipe and annulus, Pressure drops in pipe and pipe annuli, Use of Kern's design data and conversion factors.

Shell and Tube Heat Exchangers
Components of a shell and tube heat exchanger- tubular elements, shell and shell cover, channel cover, tube sheet, baffles, tie rods and spacers, Codes and standards for heat exchangers, General design considerations.

Heaters and Coolers
Stream temperatures, LMTD and correction factor, Fluid allocation, Calculation of equivalent diameters- tube side and shell side, Mass velocities on shell side and tube side, Fluid velocities and Reynolds number calculation, Shell side and tube side heat transfer coefficients, Dirt factor, Area of heat exchangers and pressure drop calculation. (**16 hrs)**

UNIT II: Condensers
Film and drop wise condensation, Condensation outside and inside horizontal tubes, Condensation inside and outside vertical tubes, Condensation of steam, Mean temperature difference, Condensation of a single vapor, Condensing film coefficients in horizontal and vertical heat exchangers, Pressure drop in condensers. **(15 hrs)**

UNIT III: Evaporators
The mechanism of vaporization, Use of steam tables, Classification of vaporizing equipment, Multiple effect evaporation-forward feed, backward feed and mixed feed, Vacuum operation of a process, Barometric condensers, Chemical evaporators, Forced circulation evaporators, Boiling point elevation, Material and energy balances for an evaporator, The calculation of chemical evaporators- Design of a multiple effect chemical evaporators with and without boiling point rise. **(15 hrs)**

On completion of each unit, students have to submit one assignment from every unit.

COURSE OUTCOMES (COs):

After completing the course, students will be able to:
CO1: Identify and apply the standard procedures for the design of heat exchangers.
CO2: Understand and congregate the required data from the standard code book and design the heat transfer equipments.
CO3: Design and evaluate heat exchangers, condensers and evaporators.
CO4: Understand the various design procedures of the heat transfer equipments.
CO5: Apply the basic chemical engineering principles to design the various heat transfer equipments.

TEXT BOOKS:

1. Donald Q Kern, 'Process Heat Transfer', Tata McGraw- Hill Publishing Company Limited, 2007

REFERENCE BOOKS:

1. J.M. Coulson, J.F. Richardson and R.K. Sinott, "Chemical Engineering-Vol. 6" by Pergamon Press, 4th Edition, 2010.

OPEN SOURCE LEARNING:
http://nptel.ac.in/
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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **VI**
Subject: **Petroleum Refinery Engineering** Code: **C019631(019)**
Periods per week (L-T-P):**(2-1-0)** Credits:**03**
NumberofclassTesttobeconducted**:2 (Minimum)**
No. of assignment to be submitted:**05**
Scheme of Examination(Theory):**Total Marks-150[ESE-100,CT-20,TA-30]**

PREREQUISITES: Knowledge of Physics Physics and Chemistry.

COURSEOBJECTIVES:

1. Brief information about petroleum refineries in India.
2. Understand the mechanism of petroleum distillation process and their end product applications.
3. Knowledge on cracking and coking in process of petroleum product production.
4. Illustrative knowledge on reforming and isomerization reaction in refineries.
5. Understand the basic concept and process involves in petroleum refining process.

COURSEDETAILS:

Unit 1: Petroleum refining in India **(06 hrs)**
Various petroleum products, Physical properties of petroleum products, World reserves of crude, Production and consumption position, Composition of petroleum crude, Introduction of Refining, Types of refineries Pollution by Refineries, New trends in refinery.

Unit 2: Distillation and Equilibrium **(06 hrs)**
Dehydration and desalting of crude oil, Reflux ratios, Types of trays, Trays efficiencies, Types of distillation used in petroleum industries, Various units in modern oil refinery, Various petroleum products properties and applications, Treatments of important products (sweetening, dewaxing deoiling, deasphalting).

Unit 3: Cracking and Coking **(06 hrs)**
Types of cracking, Reactions and operating variables of thermal and catalytic cracking, Visbreaking, Various processes for catalytic cracking (fixed bed, moving bed and fluidized bed catalytic cracking), Deep catalytic cracking, Coking (delayed coking and fluidized bed coking).

Unit 4: Reforming & Isomerization **(06 hrs)**
Types of reforming, Reforming reactions, Catalyst used in reforming, Operating variables, Various processes. Isomerization reactions, Reformulatedgasoline.

Unit 5:Rebuilding of Hydrocarbons **(06 hrs)**
Alkylation and its process, Polymerization and its process, Oxidation, Hydration, Halogenations, Nitration, Depolymerization, Hydrogenation, Dehydrogenation, Automation in petroleum refinery.

Oncompletionofeachunit,studentshavetosubmitoneassignmentfromeveryunit.

COURSE OUTCOMES:

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

CO1. Acquire the complete knowledge of Indian and other countries petroleum industries and their properties.
CO2. Understand the concept of distillation process in petroleum refinery industries.
CO3. Understand the cracking and coking as well as various processes involves in petroleum refining.
CO4. Understand the reforming and isomerization reactions.
CO5. Understand the detail knowledge of rebuilding of hydrocarbons and processes related to it.
CO6. Understand the complete knowledge of petroleum production processes and petroleum industries.

TEXTBOOKS:

1. G N Sarkar “Advanced PetroleumRefining”.
2. N K Sinha “Petroleum Refinery and Petrochemicals”, UmeshPublications.

REFERENCEBOOKS:

1. Bhaskara Rao B.K.,”Modern Petroleum Refining Processes”.
2. B K Sharma. “Fuels and Petroleumprocessing”.

OPENSOURCELEAENING:

http://nptel.ac.in/http://ocw.mit.edu/courses/chemicalengineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester:**VI**
Subject: **Polymer Science and Engineering** Code: **C019632(019)**
Periods per week(L-T-P):**(2-1-0)** Credits: **03**
Number of class Test to be conducted**: 2(Minimum)**
No.ofassignmenttobesubmitted:**05**
Scheme of Examination (Theory): **Total Marks-150[ESE-100,CT-20,TA-30]**

PREREQUISITES: Knowledge of Engineering Chemistry.

COURSEOBJECTIVES:

1. The learn the general properties, manufacturing process and applications of the different class of polymeric materials
2. To study the characteristics, testing and processing of polymers.
3. To understand the structure-property relation of the different classes of plastic materials.
4. To apply the knowledge of advanced polymer in industrial application.

COURSEDETAILS:

Unit 1: Introduction to polymers, classification and nomenclature, polymer structure – property relationship. Glass transition temperature and crystallinity in polymer. Molecular weights of polymers. Polymer solutions : The process of polymer dissolution and thermodynamics of polymer dissolution. Viscosity study of polymer solutions. **(08 hrs)**

Unit 2: Polymer Synthesis and Reaction Engineering: Condensation polymerization, Addition polymerization, Ionic and Coordination polymerization, Co-polymerization, Polymerization conditions and polymer reactions. **(06 hrs)**

Unit 3: Testing and characterization of polymers: Electric properties, weatherability, optical, chemical resistance, spectral characterization, thermal analysis, Flammability, surface characterization, Amorphous region determination, particle size. Rheology and physical tests: Stress strain behavior and relationships. **(08 hrs)**

Unit 4: Polymer processing: Plastics, elastomeric and fibers. Compounding and processing techniques. Industrial Polymers: Manufacturing Processes and Applications Hydrocarbon plastics and elastomers, PAN, Polyamides, polyurethanes, Bakelite, PMMA, PTFE, polysulfone, silicon polymer, epoxy resins, polycholoroprene, cellulose and its derivatives, urea formaldehyde and melamine formaldehyde.
(08 hrs)

Unit 5: Polymer Technology: Fibers, elastomers , films and sheets, polymeric Foams, high performance thermoplastics, conductive polymers , smart materials, Adhesives and coating, geotextiles, solid waste, Biocompatible polymer, polymer nanocomposites, construction and buildings.: Fire retarding polymers, Polymer blends and composites. Biodegradable Packaging, Polymers in Aerospace Applications, Polymers in Corrosion Prevention and Control.
(10 hrs)

Oncompletionofeachunit,studentshavetosubmitoneassignmentfromeveryunit.

COURSE OUTCOMES:

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

CO1. Acquire the complete knowledge of different class of polymeric materials.
CO2. Understand the concept of general properties of various polymeric materials.
CO3. Understand the manufacturing process of different polymers.
CO4. Define and establish the significance ofpolymer synthesis and reaction engineering.
CO5. Interpret and demonstrate the advance application of polymers and its recent trends.

TEXTBOOKS:

1. F.W.Billmeyer, Text Book of Polymer Sciences,3rd Ed., Wiley Inter Science,1984.
2. Dawande S.D., Introduction to Polymer Science & Technology, Denett .Co.
3. Polymer science**:** V.R**.** Gowarikar, N**.** V**.** Viswanathan and J**.** Sreedhar, Wiley-Eastern**.**

REFERENCEBOOKS:

1. F. Rodriguez, Principles of polymer systems, 4th Ed., Taylor and Francis,Washington, 1996
2. Encyclopedia of Polymers Science and Technology, John Wiley-Inter Science.
3. Hand book of polymer testing, Roger Brown. Rapra technology Ltd.UK.
4. Introduction to polymer chemistry**:** R**.** B**.** Seymour, McGraw Hill**.**

OPENSOURCELEARNING:

http://nptel.ac.in/
http://ocw.mit.edu/courses/chemicalengineering

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **VI**
Subject: **Mass Transfer-I Lab** Code: **C019621(019)**
Period per week (L-T-P): **(0-0-2) / Week** Credit: **01**
Scheme of Examination (Laboratory): **Total Marks- 60 [ESE-40**, **TA- 20]**

PREREQUISITES: Knowledge of Mass Transfer-I, Fluid Mechanics, Chemical Engineering Thermodynamics, Chemical Reaction Engineering, Engineering Mathematics, Physics and Chemistry.

COURSE OBJECTIVES:

1. The general objectives of Separation Process-I are to discuss the fundamental concepts of Mass Transfer principles to apply those concepts to real engineering problems.
2. This course will provide an overview of Mass Transfer Operations at basic to an intermediate level.
3. This course will applies the concepts of diffusion mass transfer, mass transfer coefficient, convective mass transfer, inter-phase mass transfer, equipments for gas liquid operations, absorption and distillation.

PRACTICAL DETAILS: ***List of Experiments***

1. To determine the Diffusivity Coefficient of Acetone in Air by Natural Diffusion.
2. To determine the Diffusivity Coefficient of Acetone in Air by Forced Diffusion.
3. To determine the Rectification Characteristics of Binary Liquids systems.
4. To plot Vapor Liquid Equilibrium (V.L.E.) diagram of Binary Liquid.
5. To determine the Relative Volatility of Binary Liquid (Benzene Toluene Mixture) by Simple Distillation.
6. To determine the Relative Volatility of Binary Liquid (Benzene Toluene Mixture) by Steam Distillation.
7. To verify Rayleigh's Equations for Differential Distillation in Binary System.
8. Study of operation of Laboratory Scale Bubble cap Column.
9. Study of operation of Laboratory Scale Absorption Column.
10. Study of operation of Laboratory Scale Wetted Wall Column.

COURSE OUTCOMES:
On completion of the course, students will be able to:

CO1. Define and establish the significance of mass transfer coefficient and overall mass transfer coefficient in correlation to different theories and analogy.
CO2. Illustrate and solve the intricate problems of different distillation operations efficiently.
CO3. Exemplify and make useful solution ofthe complex problems of absorption principles and theories.
CO4. Demonstrate and elucidate the complicated calculations of diffusion, distillation and absorption tower.

TEXT BOOKS:

1. Treybal, R.E., "Mass Transfer Operations", McGraw –Hill International Edition, 3rd Ed., 1998.
2. McCabe, W.L., Smith, J. and Harriot, P., "Unit Operation of Chemical Engineering", McGraw-Hill International Edition, 6th Ed., 2001

REFERENCE BOOKS:

1. Geankoplis, C.J., "Transport Process and Unit Operations", Prentice Hall, 3rd Ed., India, 1993.
2. Badger, W.L., Banchero, J.T. " Introduction to Chemical Engineering", Tata McGraw Hills Publishing Company Limited , 3rd Ed., 1997

OPEN SOURCE LEARNING:

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http://ocw.mit.edu/courses/chemical-engineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester:**VI**
Subject: **Transport Phenomena Lab** Code: **C019622(019)**
Periods per week(L-T-P):**(0-0-2)** Credits:**01**
Scheme of Examination (Laboratory):**Total Marks-60[ESE-40,TA-20]**

PREREQUISITES: Knowledge of Fluid mechanics, Heat and Mass Transfer.

COURSEOBJECTIVES:

6. Adequate knowledge and deterministic approach on transport phenomena of momentum, heat and mass.
7. understanding of laws governing transport processes and effect of various parameter
8. Understand the basic concept and process involved in Chemical industries.
9. To provide an understanding of velocity, temperature and concentration distribution under laminar flow

Practical DETAILS:

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To determine coefficient of discharge of venturi and orifice meter.
2. To study sudden expansion & contraction and determination of the losses.
3. To determine Reynolds number of flowing fluid and draw fiction factor curve.
4. To determine discharge coefficient of weir notch.
5. To study heat transport in double pipe heat exchangers.
6. To study heat transport in shell and tube heat exchangers.
7. To determine the heat transfer coefficient for heat flow through composite wall.
8. To study the heat transport phenomena and determine the coefficient of pin fin extended surfaces
9. To study heat transfer phenomena in convection apparatus.
10. To study pressure drop in packed bed apparatus.
11. To study fluidisation phenomena of fluidized bed.
12. To determine diffusion coefficient of natural diffusion system.
13. To determine diffusivity in forced diffusion system.
14. Study of humidifier.
15. Study of spray dryer

COURSE OUTCOMES:

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

CO1. Define and exemplify the transport phenomena involved in chemical engineering processes.
CO2. Explain and apply the different fundamentals to develop the models for chemical engineering system.
CO3. Demonstrate and analyse the different model solving ability for various chemical engineering process.

Recommended Books:

1. Transport Phenomena, Biron R. Bird, Warren E. Stewart, and Edwin 2.Lightfoot.
2. Transport Processes and Unit Operations (1997) Christie J. Geankoplis, Prentice hall of India. 3. Perry's Chemical Engineers Handbook, Eighth Edition, Don Green, Robert Perry.

Open Source Learning

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **VI**
Subject: **Process Equipment Design-II Viva** Code: **C019623(019)**
Period per week (L-T-P): **(0-0-2) / Week** Credit: **01**
Scheme of Examination (Laboratory): **Total Marks- 60 [ESE-40, TA- 20]**

PREREQUISITES: Knowledge of Engineering Mathematics, Heat Transfer Operations and Process Equipment Design-II.

COURSE OBJECTIVES:

1. To understand the basic chemical engineering principles applicable to design heat transfer equipments.
2. To apply standard codes for design of heat transfer equipments.
3. Design of heat exchangers, condensers, evaporators and to understand the various design parameters.

COURSE DETAILS (At least ten experiments):

1. Problems on counter current flow type double pipe heat exchangers in series-parallel arrangement.
2. Problems on co-current flow type double pipe heat exchangers in series-parallel arrangement.
3. Problems on counter current flow type shell and tube heat exchangers in series-parallel arrangement.
4. Problems on co-current flow type shell and tube heat exchangers in series-parallel arrangement.
5. Problems on horizontal condensers.
6. Problems on vertical condensers.
7. Problems on multiple effect evaporation-forward feed.
8. Problems on multiple effect evaporation-backward feed.
9. Problems on multiple effect evaporation-mixed feed.
10. Problems on design of design of a multiple effect chemical evaporators with and without boiling point rise.

COURSE OUTCOMES (COs):

CO1: Understand key concepts and design procedure of various heat transfer equipments.
CO2: Estimate the physical dimensions of each part of the process equipments and their accessories.
CO3: Apply the standard codes for designing of heat transfer equipments.

TEXT BOOKS:

1. Donald Q Kern, 'Process Heat Transfer', Tata McGraw- Hill Publishing Company Limited, 2007

REFERENCE BOOKS:

1. M. Coulson, J.F. Richardson and R.K. Sinott, "Chemical Engineering-Vol. 6" by Pergamon Press, 4th Edition, 2010.

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Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **VI**
Subject: **Petroleum Refinery Engineering Lab** Code: **C019624(019)**
Period per week (L-T-P): **(0-0-2) / Week** Credit: **01**
Scheme of Examination (Laboratory): **Total Marks- 60 [ESE-40**, **TA- 20]**

PREREQUISITES: Knowledge of Applied Physics and Chemistry.

COURSE OBJECTIVES:

4. Adequate knowledge and deterministic approach on the physical and chemical properties of different categories of petroleum products.
5. Ability to apply conceptual ideas and correlate the technical theories during experimentation.
6. Illustrative understanding about the characterizations of different types of petroleum products as well as their applications by hands on training.
7. Demonstrative skills on the usage of the various instruments.

PRACTICAL DETAILS:

***List of Experiments* (*At least ten experiments are to be performed by each student*)**

1. To determine the viscosity of the given petroleum product and to study the variation of viscosity with respect to temperature.
2. To determine the distillation characteristics (boiling range) of the given sample using the distillation apparatus.
3. To separate a binary mixture by distillation method.
4. To determine the flash and fire point of different petroleum products.
5. To determine the cloud and pour point of different petroleum products.
6. To determine the density of different petroleumproducts.
7. To determine the moisture content of a given petroleum sample.
8. Ash test of given lubricating oil.
9. To determine the physico-chemical properties by blending of petroleum products.
10. To determine the refractive index of petroleumproducts.
11. To determine the API gravity of crude petroleum and liquid petroleum products by hydrometer method and specific gravity bottle method.
12. To determine the kinematic viscosity of the given sample of oil at various temperatures and to study the corresponding variation with respect totemperature.
13. To determine the calorific value of given fuel oilsample.

COURSE OUTCOMES:

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

CO4. Define and exemplify the physical and chemical characteristics of different types of petroleum products and calculations there under.
CO5. Describe and analyze the adopted experimental procedures of the different petroleum sampling and testing processes for significant outcomes.
CO6. Demonstrate and deduce the suitable conclusions about the various properties of the different petroleum products through exact hands on experimentation processes.
CO7. Illustrate the operating principles and working methodologies of various types of instruments used to determine the physical and chemical properties of the petroleum product samples.

TEXT BOOKS:

1. G N Sarkar “Advanced PetroleumRefining”.
2. N K Sinha “Petroleum Refinery and Petrochemicals”, UmeshPublications.
3. Bhaskara Rao B.K., “Modern Petroleum RefiningProcesses”.

REFERENCE BOOKS:

1. B K Sharma “Fuels and Petroleumprocessing”.
2. S.S. Dara “ExperimentalChemistry”.

OPEN SOURCE LEARNING:

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http://ocw.mit.edu/courses/chemical-engineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Chemical Engineering** Semester: **VI**
Subject: **Polymer Science and Engineering Lab** Code: **C019625(019)**
Period per week (L-T-P): **(0-0-2) / Week** Credit: **01**
Scheme of Examination (Laboratory): **Total Marks- 60 [ESE-40**, **TA- 20]**

PREREQUISITES: Knowledge of Polymer Science and Engineering and Engineering Chemistry.

COURSE OBJECTIVES:

8. Adequate knowledge synthesis, characterization of polymeric materials.
9. Ability to understand techniques of polymerization and processing of polymeric materials.
10. Illustrative understanding about study of polymer blends, composites and nanocomposite as an advance part of study along with thermal, electrical and dielectric study of polymeric materials.
11. Demonstrative skills on testing of polymer blends and composites.

PRACTICAL DETAILS:

***List of Experiments* (*At least ten experiments are to be performed by each student*)**

1. Synthesis of Urea-formaldehyde (condensation)
2. Glyptal resin: glycerine phthalic acid (cross linked Polymer Chemistry)
3. Polyacryonitril (bulk polymerization)
4. Polyacryonitril (emulsion polymerization)
5. Poly methylomethacrylate (emulsion of suspension Polymer Chemistry)
6. Nylon-66 (interfacial poly condensation)
7. Synthesis of polymeric nano particle.
8. Conducting polymer (electro- or peroxodisulphate oxidation)
9. Characterization of polymers:
   a) End-group analysis
   b) Viscosity and molecular mass
   c) Density of polymer by flotation methods
   d) IR spectra.
10. Purification and fractionation of polymer, polystyrene, Nylon 66, PMMA.
11. Blending and Testing of polymer Nano composite.
12. Processing of polymer blends, characterization and its testing.
13. Magnetic and electrical properties of polymers
14. Thermal analysis and degradation of polymers:
    i. TGA: Isothermal and non-isothermal;
    ii. DTA: Glass transition temperature and melting point
15. Crystallinity of polymers by density measurement.
16. Dielectric behavior of polymers.

COURSE OUTCOMES:

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

CO8. Define the different synthetic process, techniques, processing of polymeric materials and its characterization.
CO9. Develop the polymeric blends and composites materials for industry.
CO10. Demonstrate various methods of characterization techniques.
CO11. Deduce the suitable conclusions about the testing of polymer, blends and composites, polymer nanocomposite as a novel concept and illustrate the application in various engineering sectors or industry.

TEXTBOOKS:

4. F.W.Billmeyer, Text Book of Polymer Sciences,3rd Ed., Wiley Inter Science,1984.
5. Dawande S.D., Introduction to Polymer Science & Technology, Denett .Co.
6. Polymer science**:** V**.**R**.** Gowarikar, N**.** V**.** Viswanathan and J**.** Sreedhar, Wiley-Eastern**.**

REFERENCEBOOKS:

5. F. Rodriguez, Principles of polymer systems, 4th Ed., Taylor and Francis,Washington, 1996
6. Encyclopedia of Polymers Science and Technology, John Wiley-Inter Science.
7. Hand book of polymer testing, Roger Brown. Rapra technology Ltd.UK.
8. Introduction to polymer chemistry**:** R**.** B**.** Seymour, McGraw Hill**.**

OPENSOURCELEARNING:

http://nptel.ac.in/
http://ocw.mit.edu/courses/chemicalengineering/

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Program / Semester: **B.Tech (VI)**	Branch: **Humanities**
Subject: **Technical Communication & Soft Skills**	Course Code: **C000601(046)**
Total Marks (Internal Assessment): 10	L: 0 T:0 P: 2 Credit(s): 0
Internal Assessments to be conducted: 02	Duration (End Semester Exam): **NA**

UNIT-1 Communication Skills-Basics: Understanding the communicative environment, Verbal Communication; Non Verbal Communication & Cross Cultural Communication, Body Language & Listening Skills; Employment Communication&writing CVs, Cover Letters for correspondence.Common errors during communication, Humour in Communication.

UNIT-2 Interpersonal communication: Presentation, Interaction and Feedbacks, Stage Manners, Group Discussions (GDs) and facing Personal Interviews, Building Relationships, Understanding Group Dynamics- I, Emotional and Social Skills, Groups, Conflicts and their Resolution, Social Network, Media and Extending Our Identities.

UNIT- 3 Vocational skills: Managing time: Planning and Goalsetting, managing stress: Types of Stress; Making best out of Stress, Resilience, Work-life balance, Applying soft-skills to workplace.

UNIT-4 Mindsets and Handling People: Definitions and types of Mindset, Learning Mindset, Developing Growth Mindset, Types of People, How to Lead a Meeting, How to Speak Effectively in Meetings, Behavior & Roles in Meetings, Role Play: Meeting.On Saying "Please", How to say "NO".

UNIT-5Positive Pschycology: Motivating oneself, Persuasion, Survival Strategies, Negotiation, Leadership and motivating others**,** controlling anger**,** Gaining Power from Positive Thinking.

Text Books:

1. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
2. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.
3. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.

Reference Books:

- Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
- Peale Norman Vincent. The Power of Positive Thinking: 10 Traits for Maximum Result. Paperback Publication. 2011.
- Klaus, Peggy, Jane Rohman& Molly Hamaker. The Hard Truth about Soft Skills. London: Harper Collins E-books, 2007.

Course Outcomes

1. Learn to listen actively to analyse audience and tailor the delivery accordingly.
2. Increase their awareness of communication behaviour by using propriety-profiling tool.
3. Master three "As" of stressful situation: Avoid, Alter, Accept; to cope with stressors and create a plan to reduce or eliminate them.
4. Develop growth mind-set and able to handle difficult person and situations successfully.
5. Develop technique of turning negativity into positivity and generate self-motivation skills.