CMC-501 Mass Transfer-I

Unit I

Fundamentals of Mass Transfer: Individual and film coefficients, overall mass transfer coefficient and their inter relationships; Analogies in transfer processes, determination of mass transfer co-efficient; two phase flow in packed beds, co-current and counter current processes flooding loading, column internals: types of trays/ plates and packing, point and plate efficiency.

Unit II

Diffusion phenomenon: Introduction, Types of diffusion in fluids. Types of diffusion in solid. Measurement and calculations of diffusivities. **Eddy diffusion:** Mass transfer coefficients and their correlations. Theories of mass Transfer. Interphase mass transfer, Mass transfer theories: film theory Penetration theory and surface renewal theory.

Unit III

Humidification and Dehumidification: Principles, vapour-liquid equilibria, enthalpy of pure substances, basic definition of all humidification terms, wet bulb temperature relation, psychrometric chart, Lewis relation, methods of humidification and dehumidification, equipment like cooling towers, tray towers, spray chambers, spray ponds, cooling tower design – HTU, NTU concept, calculation of height of cooling tower.

Unit IV

Drying: Drying Equilibria. Drying rate curves. Mechanism of drying. Calculation of batch and continuous drying. Drum dryers, spray and tunnel dryers. **Crystallization:** Factors governing nucleation and crystal growth rates. Controlled growth of crystals. Yield calculations and energy balance. Different types of crystallizer equipments. Fractional crystallization.

Unit V

Adsorption: Theories of adsorption, types of adsorbent; activated carbon, silica and molecular sieves, Isotherms, Industrial adsorbents. adsorption; Break through curves, Stagewise operations, Adsorptions calculations and equipments.

Reference Books:

1. Treybal, R.E., Mass Transfer Operations, 3rd Edition, McGraw Hill, 1981.
2. Ananthraman, K.M. Begum, M.S., Mass Transfer Theory and Practice, PHI New Delhi, 2011.
3. Coulson JM, Richardson JF and Sinnott RK, Chemical Engineering Vol I, II, IV and V, 4th Edition, Pergmen Press, 1998.
4. Badger & Banchero, Introduction to Chemical Engineering, TMH, 6th Reprint, 1998.
5. Geankoplis, C. J., Transport Processes and Unit Operation, Prentice Hall(I, 2000.
6. Mc-Cabe W.L, Smith J.M.; Unit Operation In Chemical Engineering; Tat Mc-GrawHill.
7. Sherwood, T.K. Pigford R.L. and Wilke, C.R.; Mass Transfer; Mc. Graw Hill.

List of Experiment:

1. Determination of relative volatility of a given system of acetic acid water.
2. To prepare the drying rate curve for fluidized bed dryer.
3. To study the characteristics of spray dryer.
6. To study the characteristics of drum and Tunnel dryer.
4. To study the drying characteristics of a wet granular material using natural and forced circulation in tray dryer.
5. Tray Dryer – To calculate rate of Drying
6. Rotary Dryer – To study the Characteristics of Rotary Dryer
7. Liquid Diffusion – To calculate the Diffusion Coefficient for a liquid –liquid system
8. To study Solid in air Diffusion
9. To study the characteristics of cooling tower
10. Humidifier and Dehumidifier – To study the Characteristics
11. Interphase Mass Transfer Coefficient – To calculate the individual and overall Mass Transfer Coefficient.

CMC-502 Heat Transfer

Unit I

Introduction: Fundamentals of heat transfer, basic modes of heat transfer. Concept of driving force and heat transfer coefficients, rate expressions for three modes i. e. conduction, convection, radiation. Calculation of overall heat transfer coefficients.

Unit II

Heat transfer by conduction: Fourier's Law, thermal conductivity, conduction through a at slab, composite slab, conduction through a cylinder, composite cylinder, conduction through sphere, composite sphere. Critical radius of insulation. Concept of thermal resistance, Theory of insulation, fouling factors.

Unit III

Heat transfer by convection:

Fundamental considerations in convective heat transfer, significant parameters in convective heat transfer such as momentum diffusivity, thermal diffusivity, Prandtl number, Nusselt number, dimensional analysis of convective heat transfer-Natural and Forced convection equivalent diameter for heat transfer, estimation of wall temperature, correlations for heat transfer by natural convection from hot surfaces of different geometries and inclination.

Unit IV

Heat transfer by radiation: Emissivity, absorptivity, black body, grey body, opaque body, concept of shape factor, stefan boltzmann, kirchhoff law. Equations for rate of heat transfer by radiation for various cases. Basic unsteady, state radiation heat transfer.

Unit V

Heat Exchangers: Classification and types of heat exchangers, Double pipe heat exchanger, calculation of LMTD, effectiveness NTU method. Introduction to Shell and Tube Heat Exchanger. heat transfer in agitated vessel, heat flux temperature diagram for boiling and condensation under vertical and horizontal surfaces, nucleate & pool boiling, effect of surface condition on condensation, correlation for heat transfer under condensation.

Evaporation- Type of evaporators and their applications single and multiple effect evaporators,

Reboiler: Design Kettle type reboiler, horizontal thermosyphon reboiler, vertical thermosyphon reboiler. Engineering problems and trouble shooting.

References:

1. Donald Q. Kern; Process Heat Transfer; Tata McGraw Hill.
2. Alan J. Chapman; Heat Transfer; Collier McMillan.
3. Rao Y.V.C; Heat Transfer; PHI

List of Experiment:

1. To determine the thermal conductivity of metal rod.
2. To determine the equivalent thermal conductivity of composite wall.
3. To determine heat transfer coefficient in force convection.
4. To determine heat transfer coefficient in Natural convection.
5. To determine heat transfer coefficient with the help of Stefan Boltzmann Apparatus.
6. To calculate emissivity of the test plate by emissivity measurement apparatus.
7. To determine heat transfer coefficient in double pipe heat exchanger.
8. To study the heat transfer characteristics of a shell and tube heat exchanger (heating/cooling) of water.
9. To determine heat transfer coefficient in parallel and counter flow heat exchanger.
10. To measure the rate of evaporation using an open pan evaporator.
11. To measure the rate of condensation of pure water vapour and to determine the heat Transfer coefficient.
12. Demonstrate the film-wise drop-wise condensation and determination of he heat transfer coefficient.
13. To study the single effect evaporator and find out the heat transfer coefficient

CMC- 503 Environmental Engineering

Unit-I

Environmental Management: Nature of environment, major component of life support system industrial development and environmental degradation, environmental impact assessment, national environmental policies, environmental guidelines for process industries, environmental pollution control through planned industrial development; environmental pollution and its effect on human beings, animal and vegetation system.

Unit-II

Air Pollution: Sources and effect of air pollution, classification of air pollutants, emission standard of air pollution. Meteorological condition influencing air pollution, Chemical inversion, principle, working and design of control equipment for particulate emission and gaseous pollutants like cyclone separator, gravity settling chamber, multi-tray settling chamber, bag filter, scrubber, E.S.P.

Unit-III

Water Pollution: Sources and effect of water pollution, water born diseases, classification of water pollutants, physical, chemical and bacteriological analysis of water; pollution laws and limits, effluent standards;, design of waste water and industrial effluent treatment plants (physiochemical and biological), advanced treatment methods, modern trends in sedimentation and filtration.

Unit-IV

Pollution due to Solid Waste and Noise: Nature of domestic, municipal, agricultural, industrial, Hospital, Nuclear Wastes; collection, treatment and disposal of solids waste; waste recovery system, solid waste management; noise pollution, sources, noise measurement and control; noise mitigation measures.

Unit-V

Case study with respect to air, water and solid waste: Fertilizer industry, refinery and petrochemical industries, pulp and paper industries, training industry, sugar and alcohol industries, alkali industries, cement and steel industries.

References:

1. Rao C S; Environmental Pollution Control Engineering; New Age India Ltd.
2. Mahajan S P; Pollution Control in Process Industries
3. Canter Lary; Environmental Impact Assessment; TMG
4. Keily; Environmental Engineering; TMG
5. Miller GT Jr; Environmental sciences-working with earth; Cegage Pub

List of Experiments:

1. To determine the BOD of a given water Sample.
2. To determine the D O of a given water Sample.
3. To determine the COD of a given water Sample.
4. To determine the pH value of a given water Sample.
5. To determine the Chlorides in a given water Sample.
6. To determine the Acidity in a given water Sample.
7. To determine the Alkalinity in a given water Sample.
8. To determine the Total Hardness in a given water Sample.
9. To determine the Turbidity of a given water Sample.
10. To determine the Aerobic Microbial colony count.
11. To determine the Total dissolve solid of a given sample.

CMC-504 (A) Oil & Paint Technology

Unit-I

Chemistry of Oils, Fats and Fatty Acids: i. Glycerides, ii. Fatty Acids, iii. Non Glyceride Components of Oils & Fats iv. Chemical Reactions of Fats and Fatty Acids.

Unit-II

Technology and Production of Oils & Fats, Coconut, cotton seed, peanut, palm, sunflower, sesame, softlower, rice fran, rapeseed and mustard seed, linseed, soyabean, tung, casteroil lard and tallow. Minor Oils: Neem Oil and Salfat. a) Mechanical expression of oils, b) Solvent extraction of oilseed and oil bearing material, c) Fat splitting. Refining and Bleaching.

Unit-III

Degumming, alkali refining (batch refining), Miscella refining, refining loses – Bleaching by absorption – continuous bleaching.

Unit-IV

Hydrogenation : Mechanism – selectivity as applied to the reaction and catalysis, Hydrogenation in practice (Batch & continuous) preparation of Raney Nickel catalyst, Soap manufacture : Raw materials required, selection of raw materials – full boiled process.

Unit-V

Nutritional functions of fats, Testing and important analysis of oils and fats in determining the quality and quantity of oils / fats and oilseed; such as moisture, oil content, F.F.A., protein content, color of the raw / refined oil.

References:

1. Feireidoon Shahidi, Bailey‘s Industrial Oil and Fat Products
2. E. Bernardini, Oils & fats Technology
3. W.M.Morgan, Outlines of Paint Technology
4. V.C.Malshe & Meenal Sikchi, Basics of Paint Technology, Part I & II,.

CMC-504 (B) Ceramic Technology

Unit-I

Introduction – Definition, classification and scope of ceramics, Ceramics Vs. metals and organics, Historical perspective on the development of ceramics and ceramic industries.

Unit-II

Elementary ideas about the raw materials used in pottery, Heavy clayweres, Refractoriers, Glass, Cement, Industries, Raw materials – clays and their classification, Quartz, Polymorphism of quartz, Feldspar and its classification, Talc, Steatite and Mica.

Unit-III

Conventional ceramics – Classification, Elementary ideas about whitewares, Cement, Glass, Refractories, Glaze and Enamels their manufacture and applications. Newer ceramics – classification and scope of Cermets, Abrasives, Electro ceramics.

Unit-IV

Bio-ceramics, Space ceramics, Automotive ceramics, Superconducting ceramics, Elementary ideas of their preparation and their applications. Fabrication methods: Classification and scope of various fabrication methods. Brief study of dry semi dry pressing extrusion, Jiggering and jollying, Slip casting HP & HIP, Drying of ceramics, Biscuit firing and glost firing, fast firing technology, action of heat on triaxial body.

Unit-V

Elementary ideas of various furnaces used is ceramic industries. Applications of ceramic products in everyday life, in different fields such as Metallurgy, Civil Engineering, Electrical, Electronics, Automobiles, Aerospace and Energy Engineering.

References:

1. F. Singer and Singer S.S, Industrial Ceramics.
2. F.H. Norton, Elements of Ceramics
3. W.D. Kingery, Introduction to Ceramics
4. Alan G. King, William Andrew, Ceramic Technology and Processing.

CMC-504 (C) Environmental Pollution & Pollution Control

Unit-I

Interaction of man and environment, overall picture of environmental pollution, environmental air and water quality criteria, standards and acts, effects of pollution.

Unit-II

Air Pollution: dispersion of pollutant in the atmosphere, meteorological factors of air, stability and inversion of atmosphere, control of air pollution, air pollution control equipments. Methods of measuring and sampling of gaseous and particulate pollutants in ambient air and industrial waste gases.

Unit-III

Water Pollution: Sources, types of pollutants in liquid wastes of chemical industries, methods for the treatment of liquid wastes to control pollution, selection of pollution control equipment, Methods of sampling of waste water. Odour and its control.

Unit-IV

Solid Waste Disposal: Characterization of solid wastes, problems of collection and handling, various processing techniques used in solid waste management, solid waste as resource material,

Unit-V

Noise pollution: noise control criteria, noise exposure index, Control.

References:

1. C. S .Rao, Environment Pollution Control and Environmental Engg.
2. Peavy and Row, Environmental Engineering.
3. A.C. Stern, Air Pollution – Engg. Control of Air Pollution Vol IV.
4. J. O .M. Bockris, Environmental Chemistry

CMC-505 (A) Novel Separation Technology

Unit–I

Limitations of common separation techniques – sedimentation, screening, filtration, evaporation, distillation, absorption, liquid-liquid and solid-liquid extraction. Principles of membrane separation process classification, characterization and preparation of membrane.

Unit-II

Analysis and modeling of membrane separation, Membrane modules and application. Reverse Osmosis and ultra-filtration, membrane characteristics and applications, Ion- selective membranes and their application in electrolysis.

Unit-III

Vaporization and gas separation using membranes, Liquid membrane, Industrial applications. Liquid membrane separation, critical extraction, pressure swing adsorption and freeze drying, pervaporation and permeation, nano-separation. Foam and bubble separation, principle, classification, foam and surfactants, Separation techniques, Column Separations.

Unit-IV

Multi-component separation, Zone melting and Zone refining, electrophoresis, desalting by freezing, centrifugation.

Unit-V

Parametric pumping, thermal parametric pumping, batch, continuous pumping, pH-parametric pumping, heatless parametric pumping.

References:

1. Seader J. D. and Henley E. J., Separation Process Principles.
2. Suresh S, Keshav, A Textbook of Separation Processes.
3. King C. J, Separation Processes.
4. Arden T. V., Water Purification By Ion-exchange.

CMC-505 (B) Petroleum Processing Technology

Unit I

Origin and occurrence of petroleum crude, status of petroleum refining in India; composition of petroleum, classification and physical properties of petroleum.; evolution of crude oil and petroleum products, future refining trends.

Unit II

Crude oil distillation process, pretreatment of crude, atmospheric and vacuum distillation process; secondary conversion processes; catalytic reforming, catalytic cracking and deep catalytic cracking.

Unit III

Heavy residue up-gradation technologies; hydro-cracking, hydro-treating, vis-breaking and delayed coking alkylation, isomerisation, dehydrogenation processes, polymerization.

Unit IV

Lubricating oil, grease and bitumen: de-waxing and de-oiling, de-asphalting, lube hydro-finishing, bitumen air blowing, sweetening and desulphurization; hydro-desulphurisation of petroleum products.

Unit V

Refinery products, refinery gas utilization, LPG, propylene and hydrogen recovery, reformulated gasoline; present and future requirements.

References:

1. Nelson WL; Petroleum refinery engineering ; Mc. Graw hill
2. Hobson GD; Modern petroleum technology Part I & II; John Wiely & sons.

CMC-505 (C) Conventional & Non-Conventional Energy Sources

Unit-I

Global and National energy scenario, Conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems.

Unit-II

Energy and development role of energy in industrial activity. Contemporary energy crisis, conventional and non-conventional energy sources, energy demand and availability. Energy audit need for energy conservation.

Unit-III

Solar energy system, introduction to wind energy conversion, Wind turbines, Wind farms, Bio energy system, design and constructional features.

Unit-IV

Thermal renewable energy systems, appropriate energy technology for rural development, energy conservation, environmental aspects of renewable energy systems.

Unit-V

Fluidized bed combustion. Energy conservation in use of heat. Economical design of furnace, water treatment, drying, conditioning and industrial space heating, boiler accessories etc. Heat recovery in waste heat boilers: Conservation, integrated energy systems for industries.

References:

1. Rakosh das begmudre, Energy conservation systems
2. GD Das, Non conventional energy sources
3. S.P. Sukhatme, Solar Energy by Padmashree
4. Harvey A., Dunn J.J, Solid waste Conversionto Energy
5. S. Rao & B.B. Parulka, Energy Technology

CMC-506 (A) Polymer Technology

Unit-I

Polymerization Chemistry: Chain, step and miscellaneous polymerization reactions and polymerization technique. Polymerization kinetics: Free radical, cationic and anionic polymerization, poly-condensation and polymerization.

Unit-II

Polymerization Processes: Bulk solution, emulsion and suspension polymerization, thermoplastic composites, fiber reinforcement fillers, surface treatment reinforced thermo-set composites resins, fillers, additives.

Unit-III

Polymer reactions: Hydrolysis, acidolysis, aminolysis, hydrogenation, addition and substitution reactions, reactions of various specific groups, cyclyzation and cross linking reactions, reactions leading to graft and block copolymer

Unit-IV

Manufacturing processes of important polymers: Plastics- polyethylene, polypropylene polyvinyl chloride & copolymer, polystyrene; Phenol-formaldehyde, epoxides, urethane, Teflon, elastomers, robbers, polymeric oils - silicon fibers - cellulosic (Rayon), polyamides (6:6 Nylon), Polyesters (Dacron). Acrylic-olefin.

Unit-V

Composite materials - Ceramic and other fiber reinforced plastics, Polymer degradation - Thermal, Mechanical, Ultrasonic, Photo, High energy radiation, Ecology and environmental aspects of polymer industries. Rheological Sciences Equations, Uni-coelastic models - Maxwell.

References:

1. Rodringuez; Principles of polymer systems; TMH
2. Billmayer Jr, Fred W.; Textbook of polymer science; Wiley tappon
3. David J Williams; Polymer science & engineering; PHI
4. Mc. Keley, JH; Polymer processing; John Wiley

CMC-506 (B) Industrial Psychology and Human Resource Management

Unit-I

History and evolution of the concept of HRM. HRM: Definition, nature, scope, objectives and importance, Models of HRM, Policies, procedures and programs of HRM.

Unit-II

Human Resource Planning: Objectives, Importance, Process of HRP, Methods and techniques of HRP. Job Analysis: Nature and use of job analysis, methods of job analysis, Process of job analysis.

Unit-III

Recruitment: Definition, Process and methods, policies and procedures, limitations, external Vs. internal recruitment. Selection: Purpose, processes and methods.

Unit-IV

Induction and placement: Aims and objectives of placement, induction/orientation. Internal mobility: Concept, transfer and employee separations

Unit-V

Training: Need and significance. Executive development: Nature and concept, importance, the process of executive development, methods of conducting a executive development program Career Management: Nature and concept, stages of career management HRD in India: Evolution of the concept of HRD, Principles of HRD systems, HRD in Indian industry

References:

1. Dessler, G. (2009). A framework for human resource management, 5th ed. Pearson/Prentice Hall Publishing.
2. Rao, V.S.P. (2005). Human resource management: Text and cases, 2nd ed. Excel books.
3. Decenzo, D. A. & Robbins, S.P. , (2002). Human resource management. John Wiley and Sons.
4. 4Dessler, G. & Varkkey, B. Human resource management. 11th ed. Pearson Education

CMC-506 (C) Risk analysis & Hazard

Unit-I

Origin of process hazards, Laws Codes, Standards, Case Histories, Properties of Chemicals, Health hazards of industrial substances.

Unit-II

Toxicology: Toxic materials and their properties, effect of dose and exposure time, relationship and predictive models for response, Threshold value and its definitions, material safety data sheets, industrial hygiene evaluation.

Unit-III

Fire & explosion: Fire and explosion hazards, causes of fire and preventive methods. Flammability characteristics of chemical, fire and explosion hazard, rating of process plant. Propagation of fire and effect of environmental factors, ventilation, dispersion, purifying and sprinkling, safety and relief valves.

Unit-IV

Energy Hazards: Electrical hazards, noise hazard, radiation hazard in process operations, hazards communication to employees, plant management and maintenance to reduce energy hazards.

Unit-V

Risk Analysis: Component and plant reliability, event probability and failure, plant reliability, risk analysis, HAZOP AND HAZAN, event and consequence analysis (vapour cloud modelling) Designing for safety, measurement and calculation of risk analysis. Hazard Assessment: Failure distribution, failure data analysis, modeling for safety, safety training, emergency planning ad disaster management, case studies.

References:

1. Crawl D.A. and Louvar J.A, Chemical process safety fundamentals with applications.
2. Wentz, C.A, Safety health and environmental protection.
3. Smith, B.D, Design of equilibrium state process.
4. Van Winkle, Distillation.