

Chemical Instrumentation

COURSE OBJECTIVE

To gain the knowledge of different process instruments, which used in different chemical industries such as refineries, cement, polymer, insecticides, pesticides, fertilizers etc.

COURSE CONTENT

Introduction to chemical process instrumentation, process variables, static and dynamic characteristics of instruments & their general classification

Elements of measuring systems & their functions, principles, construction and operation of instruments for measurement

Control/ indication/ recording of process variables like pressure, flow, level, humidity and composition.

Principles of transducers, electro pneumatic, pneumatic, electrical & multi-pressure.

Process instrumentation diagram and symbols, process instrumentation for process equipments such as distillation column, Heat exchanger, fluid storage vessel.

COURSE OUTCOMES

1. Ability to familiarize basic concepts of chemical process instrumentation.
2. Ability to understand principle construction and operation of instrument for measurement.
3. Ability to understand control/recording of process variable like pressure flow level, humidity and composition.
4. Ability to familiarize principles of electromagnetic pneumatic, electrical and multipressure transducers.
5. Ability to design instrumentation diagrams for process equipment such as distillation column, heat exchanger and fluid storage vessel

Topics for the Laboratory

1. Time constant of pH-meter
2. Study of Bourdon tube pressure gauge
3. Study of Bellow tube pressure gauge
4. Calibration of different instruments used in chemical processes
5. Study of electro-pneumatic transducers for pressure, flow, level
6. Measurement of water level using differential pressure meter
7. Measurement of flow using electromagnetic flow meter
8. Measurement of flow using differential pressure cell across orifice/ venturimeter.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment. Laboratory assessment will be based on assignments, presentations, and interview of each candidate.

REFERENCES

1. Albert D. Cooper-Modern Electronic Instrumentation, PHI
2. Eckman-Industrial Instrumentation
3. H.S. Kalsi-Electronic Instrumentation
4. Curties Johnson-Process Control Instrumentation Technique, IV Edn, PHI
5. Harriot; Process control; TMH
6. Patranabis; Principles of process control; TMH
7. Jaggi, Mathur; Engineering Mathematics; Khanna Publisher.
8. B.G. Liptak-Instrument Engineering 'Handbook, Volume 1: Process Measurement
9. Austin E. Fribance-Industrial Instrumentation Fundamentals, New York: McGraw-Hill 1962
10. Ernest Doebelin-Measurement Systems: Application and Design, McGraw-Hill

Material & Energy Balance

COURSE OBJECTIVE The objective of this course to understand and apply the basics of calculations related to material and energy flow in the processes. In addition to make practical approach to solve industrial related material energy balance problems.

COURSE CONTENT

Mathematical and Engineering calculation- Units, different unit systems, conversion of unit from one system to other, dimensions, dimensional analysis, dimensional group, fundamental of mole concept, composition of solid, liquid and gases, Basic Stoichiometric calculation.

Ideal Gases & Vapor pressure- Introduction of ideal gas, behavior of ideal gases, real gas, Vander Waal equation, compressibility factor method to solve cubic equation, vapour pressure, Raoult's Law, Humidity, relative humidity, humid heat, humid volume, dew point, humidity chart and its use.

Material balance without chemical reaction - Fundamental of conservation of mass, Introduction of component balance, solving material balance without simultaneous equation for different unit operations, solving material balance at steady state and unsteady state, recycle, by pass and purge calculations.

Material balance with chemical reaction- Introduction of component balance, solving material balance with chemical reactions, recycles, by pass and purge calculation with chemical reactions, combustion calculations.

Energy balance - Heat capacity, calculation of enthalpy changes, calculation of standard heat of reaction, heats of formation, combustion, solution, mixing etc., effect of pressure and temperature on heat of reaction, energy balance with chemical reaction.

Topics for the Laboratory

1. Determination of boiling point relation with respect to concentration of caustic soda and verify Dehring' rule.
2. Application of dry and wet bulb thermometer to find out atmospheric humidity.
3. Use of humidity chart to find enthalpy dew point humid heat and saturation.
4. Solubility at room temperature and boiling point of urea in water and verify the material balance.
5. Crystallization of copper sulfate in saturated solution by cooling and finding out the crystal yield.
6. To find out the heating value of coal using a calorimeter
7. Combustion of coal & performing the material balance
8. Proximate analysis of coal sample
9. Measurement of flame temp and compare actual & theoretical temp (Bunsen-Burner, Sprit Lamp, Kerosene Lamp.)
10. To find the heat of reaction using calcium oxide and water.

COURSE OUTCOMES

1. Ability to familiarize with different unit systems and dimensional analysis.
2. Ability to understand concept of ideal gas, real gas, vapor pressure and humidity.
3. Ability to solve material balance problems involving recycle, bypass and purge, without chemical reaction.
4. Ability to solve material balance problems involving recycle, bypass and purge, with chemical reaction.
5. Ability to calculate energy balance using enthalpy changes and solve energy balance involving chemical reactions

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment. Laboratory assessment will be based on assignments, presentations, and interview of each candidate.

REFERENCES

1. O.A. Hougen, K.M. Watson, R.A. Ragatz; Chemical Process Principles Part I –CBS pub.
2. David M. Himmelblau-Basic Principles and calculations in chemical Engineering –PHI
3. B. I. Bhatt, S.M. Vora; Stoichiometry; TMH.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Chemical Engineering, III-Semester

Advance Engineering Chemistry

Ceramics: Definition & Classification of ceramic materials based on composition, properties & applications, Electro-ceramics, magnetic ceramics, Fine ceramics & Glass-ceramics Natural ceramic minerals & materials such as Clay family, Quartz/Quartzite, Feldspar, Bauxite family, Dolomite, Magnesite.

Refractory: Introduction: raw materials, Fabrication and firing, General manufacturing techniques, Properties and applications of following refractories: Acid (Silica) Refractories, Basic Refractories, Burnt refractories, Sintered, fused refractories, and Insulating Refractories, Castables.

Glass: Definition of glass: Thermodynamic study for glass formation, Glass transitions Conditions of vitrification; Glass processing: selection of raw materials, effects of different oxides on glass properties, batch preparation, melting in glass tank furnace, refining of glass, Forming process: Blowing, molding, shaping etc

Oils and Fats: Vegetable oils by solvent extraction, processing of animal fats, hydrogenation and esterification of oils; Soaps and Detergents Bathing & laundry soaps, cationic and anionic detergents, surface active agents.

Chemical Kinetics: Rate constant, order and molecularity of a reaction, zero, 1st, 2nd and 3rd order reactions; methods of determination of order of reactions; chemical equilibria Reaction rate theories, Arrhenius, parameters, Catalysis (including enzyme catalysis), effect of catalysis on reaction rate.

COURSE OUTCOMES

1. Ability to familiarize with ceramics and its processing.
2. Ability to understand concept of general manufacturing techniques of refractory.
3. Ability to understand concept of processing of glass and its casting.
4. Ability to understand the processing of oils and fats.
5. Ability to understand the reaction rate mechanism.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment. Laboratory assessment will be based on assignments, presentations, and interview of each candidate.

References:

1. B.S.Bahl & G. D. Tuli- Essentials of physical Chemistry. S. Chand & Publishers.
2. Glasstone – Textbook on Physical Chemistry – Prentice Hall, India, New Delhi.
3. Dryden CE- Outlines of Chemical Technology- Prentice Hall, India, New Delhi
4. Levine; Physical Chemistry; TMH.
5. Sivasamkar; Engg Chemistry; TMH
6. Jain & Jain- Engineering Chemistry – Dhanpat Rai Publishing Company, Delhi.
7. Austin G.T, Shreeves; Chemical Process Industry – McGraw Hill – Kogmina

List of Experiments

1. To determine the viscosity of a viscous liquid by falling sphere method
2. Determination of saponification value of oil sample
3. Application of pH meter to find acidity and alkalinity of a solution.
4. To study the hydrolysis of cane sugar solution in the presence of an acid by Fehling's solution method and to find out the reaction constant.
5. To determine the % composition of a given binary liquid solution by polarimeter.
6. To determine the solubility of a sparingly soluble salt in water by conductance measurement.
7. Preparation of laundry soap and to determine its yield
8. Investigation of Appropriate Refractory Material for Laboratory
9. Manufacturing of glass and ceramics in laboratory scale.

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Choice Based Credit System

Chemical Engineering, III-Semester

Chemical Engineering Thermodynamics

COURSE OBJECTIVE

The objective of this course to understand the theory and applications of classical thermodynamics, thermodynamic properties, equations of state, methods used to describe, compression and expansion of fluids.

COURSE CONTENT

Basic concepts of work & heat system, properties and state of systems; first law of thermodynamics; application, batch flow processes; steady & unsteady state flow.

Critical properties corresponding state compressibility, PVT behavior of pure fluids virial equation, cubic equation, generalized correlation & eccentric factor, behavior of liquid, second law of T.D, & its application.

Adiabatic reactions, Equilibrium in homogeneous and heterogeneous reactions.

Carnot cycle, Carnot theorem, thermodynamics temperature scales, concept of entropy, calculation of entropy for various systems, entropy for real system.

Effect of pressure on specific heat, Joule Thompson effect, third law of thermodynamics & its applications.

Compression & expansion of fluids; single stage, multiple stage requirements & efficiency along with effect & engineering along with effects clearance, compression of real gas.

COURSE OUTCOMES

1. Ability to understand basic concepts of thermodynamics and first law
2. Ability to estimate PVT behaviors and critical properties of fluids.
3. To provide knowledge & application of second law of thermodynamics.
4. To provide knowledge & application of third law of thermodynamics.
5. To analyze effect of pressure on specific heat, compression & expansion of fluids.

EVALUATION

Evaluation will be based on continuous an integral part of the class as well through external assessment.

REFERENCES

1. Smith J.M and Van Ness-Introduction to Chemical Engg Thermodynamics –6th edition
2. Daubert; Chemical Engg thermodynamic; TMH
3. Rathakrishnan E; Fundamentals of Engg Thermodynamics; PHI
4. Dodge B.F. Chemical Engineering –Thermodynamics –McGraw Hill
5. Balzhiser, Samuels and Eliassen-Chemical Engg- Thermodynamics Prentice Hall
6. Sandler S.I Chemical Engg-Thermodynamics-John Wiley and son
7. Rastogi and Mishra-Chemical Engg Thermodynamics

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Chemical Engineering, III-Semester

Material Science

Mechanical, Thermal & Electrical properties of Materials and their measurement.

Atomic Structure, Inter atomic attraction, Molecular structure, crystallinity, Solid solutions, crystal imperfections, Electronic structure and Electromagnetic properties/

Single phase metal deformation, Failure of Metals, Theories of alloying, phase relationship, iron-carbon diagram, Nomenclature of steels, utilization of cast iron, mild steel, stainless steel, lead and graphite in Chemical Engg. System.

Theories of Corrosion and corrosion – control, stability of materials in service:
Chemical, Thermal and Radiolytic stability.

Composite materials; Semiconductors, Superconductors, Surface Modifications Using linings of plastics, rubber, glass, ceramics etc.

COURSE OUTCOMES

1. Understanding the Mechanical Thermal and Electrical properties of material and their measurement.
2. Ability to know basic difference between atomic molecular and electronic structure.
3. Ability to understand utilization and selection of suitable material for chemical engineering system.
4. To understand theories and effect of corrosion.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

References:

1. Van Vlack; MATERIAL SCIENCE
2. Perry RH & Don WG; PERRY'S CHEMICAL Engineering HAND BOOK; Mc Graw Hill.
3. Murthy; Structures and properties of Engg Materials; TMH
4. Narula; Material science; TMH
5. Vijaya; Material Science; TMH
6. O.P. Khanna; MATERIAL SCIENCE & METALLURGY; Dhanpat Rai Publication.
7. S.K. Hajra Choudhry; MATERIALS SCIENCE & PROCESSES; Indian Book Distrib Co.

Chemical Engineering , III-Semester

Communication Skills

Introduction: Communication, definition and role of communication, Process of communication, Importance of professional communication, Levels of communication, Types of communication, Challenges in communication. Non –verbal communication – Body language, personal appearance, posture, gesture and hand movement, eye contact, facial expressions, paralinguistic features - proxemics, haptics, chronemics. Oral presentations. Case studies.

Books recommended:

1. Business Communication, Mc Graw Hill Education, Matthukutty M. Monippally.
2. Effective Business Communication , Mc Graw Hill Education, Neera Jain, Shoma Mukherji.
3. Technical Communication , Cengage , P. Subba Rao, B. Anita Kumar, C. Hima Bindu.
4. Business Correspondence & Report Writing , Mc graw Hills. , R.C. Sharma & Krishna Mohan .
5. Technical Communication – Principles & Practice , Oxford , Meenakshi Raman.
6. Business Communication- Mc graw Hills , Peter Cordon.
7. Communication Skills , Oxford , Sanjay Kumar & Pushpa TMH.
8. Effective Technical Communication , M. Ashraf Rizvi ,Mc Graw Hill Education.

Language Lab II

Module 1 : Reading comprehension

Module 2 : Role plays

Module 3 : Debate

Module 4 : Group discussion

Module 5 : Resume writing

Module 6 : Interview skills

Module 7 : Body language

Module 8 : Oral presentations