

CHEMICAL TECHNOLOGY / CHEMICAL ENGINEERING

(DIPLOMA STANDARD)

SUBJECT CODE:338

UNIT I: CHEMISTRY AND THERMODYNAMICS

Atomic weight and Atomic number - Molecular weight - equivalent weight - periodic table - Normality - Molality - Molarity, Boyle's law - Charles's law - General gas equation $PV = nRT$, Dalton's law of partial pressures - Avogadro's law and Avogadro's number, Law of mass action - Application of law of mass action - Le-Chatelier's principle. First law of Thermodynamics - Internal energy - Enthalpy - heat capacity - Relationship between internal energy and enthalpy, Second law of Thermodynamics: Entropy- change of entropy for an ideal gas, Third law of Thermodynamics. Free energy and work function - Fugacity and Fugacity coefficient - Activity and Activity coefficient.

UNIT II: BASIC ENGINEERING

Stress - strain - elastic constants and their relations, friction - transmission of motion and power, properties of steam, boilers - electrical quantities and units - Ohm's law - Kirchhoff's law and Faraday's law, D.C. and A.C circuits - principle and working of D.C. generator and D.C. motor, three phase transformer - principle and working and construction of A.C generator - principle and working of vacuum diode, triode - semiconductor diode and transistor - uses. Micro Processor Architecture. Fuels - Solid, liquid and gaseous fuels - Fuel properties - Calorific value of fuels - Octane number - Cetane number - Flash point - Fire point - Cloud point - Pour point - Smoke point - Freezing point and Viscosity Index.

UNIT III: CHEMICAL TECHNOLOGY

Inorganic Chemical Technology:- Sources of water - Hardness of water - water treatment by lime soda and ion-exchange process, Acids - raw materials - reactions and uses of Sulphuric acid, Hydrochloric acid and Phosphoric acid, Alkalis - Raw materials - reactions and uses of caustic soda, soda ash, fertilizers - raw materials - reactions and

uses of ammonium sulphate, ammonium chloride, ammonium nitrate, urea, NPK fertilizers, raw materials for cement and glass manufacture, constituents of paints - lacquers and varnishes.

Organic Chemical Technology:- Chemical composition of edible oils - distinction between oils and fats - definition of acid value, saponification value and iodine value, definition of detergents and soaps, composition of sugarcane and cane juice, raw materials for paper - pulp - chemical recovery from spent cooking liquor, raw materials, reactions and uses of citric acid and vinegar, petroleum - crude oil distillation, principles involved in isomerism and alkylation, polymer - addition polymerization - condensation polymerization, dye intermediates, thermoplastics and thermosetting plastics, raw materials, reactions, structure and uses of polyethylene, polypropylene, polystyrene, poly vinylchloride, nylons, phenolic formaldehyde, urea formaldehyde, melamine formaldehyde, epoxy resins and poly urethanes.

UNIT IV: STOICHIOMETRY

Basic concepts of chemical calculations - gram atom and gram mole - methods of expressing composition - weight percent - mole percent - volume percent - Definitions of terms, tie-substance, inert material, limiting reactant and excess reactant - material balance - percentage conversion and yield - simple problems - combustion - Gross and net calorific value - theoretical air requirement – flue gas analysis - Orsat analysis - Definitions and simple problems in heat of formation, heat of combustion, heat of reaction.

UNIT V: FLUID MECHANICS, INSTRUMENTATION AND CONTROL

Compressible and incompressible fluids - manometers - U-Tube and inclined tube manometers - Reynolds number - continuity equation - Bernoulli's energy theorem - Laminar and turbulent flows - pipe fittings and joints - valves - positive displacement pumps - reciprocating pumps - rotary pumps - centrifugal pumps - characteristics of centrifugal pumps - Installation and maintenance of pumps - priming and cavitation - fans - blowers and compressors. Process Instruments - process variables - static and

dynamic characteristics of instruments. Instruments for measuring pressure temperature, flow, pH, Open loop and closed loop systems - principles of feed back and feed forward control systems - controller classification such as P,I,PI, PD, PID. Control application - liquid level system - Heat Exchanger-control of temperature and flow rate - Batch Reactor-Control of temperature and pressure.

UNIT VI: MECHANICAL OPERATIONS

Types of size reduction - Energy required for size reduction - laws of crushing - principle and working of Jaw and Roller crushers, ball mill and fluid energy mill - angle of nip - particle size determination by microscopic method - sieve standards - differential and cumulative screen analyses - screen efficiency, applications of belt conveyor, screw conveyor, bucket elevator - pneumatic conveyor, principle and operation of gravity thickener, principle and applications of plate and frame filter press, leaf filter, rotary drum filter, filter medium and filter aids, principle and application of centrifuge, cyclone separator and electrostatic separator and Banbury mixer, Ko-kneader and ribbon blender - principles and applications of dialysis - reverse osmosis.

UNIT VII: HEAT TRANSFER

Steady state heat conduction - Fourier's law of conduction - thermal conductivity - analogy between heat transfer and electricity - natural and forced convection - Individual and overall heat transfer co-efficients - Radiation - Kirchoff's law and Stefan Boltzmann law - Definitions of Black body - grey body - Absorptivity - emissivity, principles and operations of double pipe heat exchanger, shell and tube heat exchanger, forced circulation evaporator, long tube vertical evaporator, evaporator economy, multiple effect evaporator, principles of refrigeration - refrigerants and their characteristics, Unsteady state heat conduction.

UNIT VIII: MASS TRANSFER OPERATIONS

Fick's law of diffusion - definitions of absolute and molal humidity - dry and wet bulb temperature - relative humidity - Raoult's law applications - Batch distillation -

Rayleigh's equation - calculation of no. of trays by McCabe - Thiele method - principle and application of steam distillation - molecular distillation - azeotropic distillation - extractive distillation, choice of solvent for absorption, characteristics of packing - random and regular packing, loading and flooding of packed towers, principle of liquid - liquid extraction - use of triangular charts - choice of solvent for extraction, mechanism of drying - critical moisture content - principle and applications of rotary, drum, spray and tunnel driers, principle of crystallization - principle of leaching and absorption - applications.

UNIT IX: CHEMICAL REACTION ENGINEERING

Types of reactions - Homogeneous and Hetrogeneous reactions - single and multiple reactions, Kinetics of chemical reactions - method's of analysis - integral method - differential method - half life method , type of reactors - batch reactor, plug flow reactor, mixed flow reactor - Qualitative analysis for multiple reactions. Non ideal reactors - types of non - ideality. Catalysis - effectiveness factor -Thiele modulus.

UNIT X: INDUSTRIAL SAFETY AND POLLUTION CONTROL

Process Safety - Causes of Accidents - Unsafe acts and conditions - Reasons for high priority towards safety in process industries - Responsibility of supervisor regarding safety - Material safety data sheet and its importance evaluating workers exposure to volatile toxicants, dusts and noise - Accident prevention - Safety training - Case study of accidents in process industry: Bhopal gas tragedy, India - Fukushima nuclear disaster, Japan Fire triangle - Different causes of fire - Distinction between fires and explosion - Flash point and fire point - Classification of flammable liquids based on ash point - Lower and Upper flammable limits (LFL&UFL) - Ignition and sources of ignition fire balls - runaway chemical reaction - confined explosion - dust explosion - Vapor cloud explosion. Pollution - sources of air pollution and control of air pollution - Green House effect - Acid rain - Industrial waste water treatment and solid wastes disposal methods.
