

**ANNEXURE I**  
**CHEMICAL ENGINEERING**

**(Includes leather, Sugar, Textile Technology, CHPC, CHPP, and CHOT)**

- 1. Material technology:** Mechanical properties of metals and Testing of materials – thermal equilibrium diagram- Production of Iron-plain carbon steels, alloy steels - Miscellaneous materials – Glass, carbon, graphite, rubber, elastomers, fiberglass and FRP etc.. – Corrosion-causes, types, methods of prevention.
- 2. Chemical process principles:** Determination of molarity, molality & normality, analysis of solids , liquids and gases on dry and wet basis , Daltons law , ideal gas equation of state , vapor pressure boiling point and freezing point , elevation of boiling point and depression of freezing point-uses, Bypassing ,Recycling & purge streams – uses , limiting component , excess reactant , percentage conversion & yield and degree of completion , Material balances with and without chemical reactions, law of conservation of energy , heat of reaction , heat of formation , and heat of combustion – related problems , gross and net calorific values , theoretical air and excess air calculations.
- 3. Organic Chemical Technology:** Coal chemicals, coking of coal, coal tar distillation, petroleum refining-atmospheric distillation and vacuum distillation , fluid catalytic cracking , catalytic reforming , petrochemicals from methane and ethylene , pulp and paper industry , oils , fats and soaps ,sugar & fermentation, rubber industries.
- 4. Inorganic Chemical Technology:** Water-sources, impurities-treatment-dissolved solids-ion exchange process and Reverse Osmosis (RO) process, manufacture of chemicals like, soda ash, ammonia, Urea, nitric acid, sulphuric acid, phosphoric acid, Super Phosphate and industrial Gases ,paints, pigments and varnishes, graphite and silicon carbide and cement.
- 5. Fluid mechanics:** Flow of incompressible fluids, Newtonian and non-Newtonian fluids, viscosity, Bernoulli's theorem, friction losses, flow meters, different types of pumps for transportation of fluids, Flow past immersed bodies, fluidization - packed bed and fluidized bed.
- 6. Heat transfer:** Conduction – mechanisms of heat flow – Fourier's law, thermal conductivity, steady state conduction- compound resistances in series, heat flow through a cylinder – related problems. Convection – heat flow in fluids- rate of heat transfer, average temperature of fluid stream – Overall heat transfer coefficient – LMTD – Fouling factors – Heat transfer to fluids with and without phase change. Radiation – fundamentals, emission of radiation, black body radiation, laws of black body radiation – radiation between surfaces.- Heat Exchange Equipment – types of heat exchange equipment, counter current and parallel current flows.- Evaporation – liquid characteristics and important properties, types of evaporators, condensers, ejectors- evaporator economy- single and multiple effect –related problems..
- 7. Mechanical unit operations:** Size reduction methods, laws of size reduction- crushers and grinders. different types of equipments for mixing dry powders, differential and cumulative screen analysis, screen effectiveness, average particle size, storage of solids, conveyers, froth floatation, electrostatic precipitator ,scrubber, cyclone separators, filtration, sedimentation.
- 8. Thermodynamics and Reaction Engineering:** 1st law of Thermodynamics, PVT relationships for gases, 2nd law of Thermodynamics, refrigeration and liquefaction, determination of equilibrium constant and conversion, Temperature and Pressure effects on reactions – Arrhenius equation. Basic equations & working of batch, tubular and stirred tank reactors, catalysis.
- 9. Mass Transfer:** Principles of diffusion, inter phase mass transfer, distillation, absorption and adsorption, humidification, membrane separation, extraction and leaching, drying, crystallization.

**10. Instrumentation & process control:** Static and dynamic characteristics of an instrument-step input, linear input, sinusoidal inputs, measurement of temperature, pressure, vacuum, liquid levels and composition. process instrumentation, diagrams and process control, different types of controllers, concepts of DCS and PLC.

**11. Environmental Studies and Pollution Control Engineering:** Scope and importance of environmental studies, segments, Eco systems, bio diversity, water pollution, types, classification, treatment methods, air pollution, types, classification, analysis, control methods, solid waste management, sources, classification, disposal, pollution control in sugar, fertilizer & petroleum industries, legal aspects.

**12. Energy Technology & Plant Operation:** Classification of energy sources-Solid, Liquid, and Gaseous fuels – Combustion principles, Refractories, Furnaces - Blast Furnace, LD Converter - Nuclear Energy, Solar Energy, Wind Energy and Bio-Energy – Energy Conservation - Industrial Hazards and Prevention -Safety and first Aid

**ANNEXURE II**  
**Number of Questions to be set Unit wise**  
**Chemical Engineering**

<b>UNIT NO</b>	<b>TOPICS</b>	<b>MARKS</b>
I	<b>Material technology</b>	06
II	<b>Chemical process principles</b>	09
III	<b>Organic Chemical Technology</b>	08
IV	<b>Inorganic Chemical Technology</b>	08
V	<b>Fluid mechanics</b>	09
VI	<b>Heat transfer</b>	10
VII	<b>Mechanical unit operations</b>	08
VIII	<b>Thermodynamics and Reaction Engineering</b>	10
IX	<b>Mass Transfer</b>	09
X	<b>Instrumentation &amp; process control</b>	08
XI	<b>Environmental Studies and Pollution Control Engineering</b>	08
XII	<b>Energy Technology &amp; Plant Operation</b>	07
<b>Total</b>		100

**ANNEXURE III**  
**MODEL QUESTIONS FOR CHEMICAL ENGINEERING**

1. Cast iron is a \_\_\_\_\_ material.
  - 1) Malleable
  - 2) Ductile
  - 3) Tough
  - 4) Brittle.
2. The average molecular weight of air is
  - 1) 20
  - 2) 24
  - 3) 29
  - 4) 80

3. In which of the following process, temperature is constant
  - 1) Isobaric
  - 2) Iso thermal
  - 3) Adiabatic
  - 4) Adiabatic compression
4. The absorptivity of a perfect black body is
  - 1) 0
  - 2) 1
  - 3) 0.5
  - 4) 0.8
5. Ball mill is used for
  - 1) Attrition
  - 2) Coarse grinding
  - 3) Fine grinding
  - 4) Crushing