1.4 Pharmaceutical Engineering (Principles of general Engineering, Environmental Pollution, Safety Hazards):

1. Material of Pharmaceutical Plant Construction: Factors affecting selection of material for pharmaceutical metals ferrous metals- cast-iron-steels, stainless steels, non-ferrous metals, copper, copper alloys, aluminium, lead tin, silver, nickel, chromium, non-metals, Inorganic glass, stonewarestone, slate brick & concrete, Asbestos, Organic-Plastic rubber and timber.

2. Corrosion & its Prevention: Introduction, types of corrosion, causes of corrosion, theories of corrosion, methods of prevention of corrosion.

3. Industrial Hazards & Safety Precautions: Mechanical, chemical, electrical, fire, dust, hazards, safety, requirements, fire-extinguishers, accident records.

4. Fluid Flow: Types of flow, types of pressure, total energy & total mechanical energy balance, losses in mechanical energy fluids, measurement of flow rate orifice, venture, pitotrota meter (Mathematical problems included).

5. Heat Transfer: Modes of heat transfer, conduction Fourier's law, resistances in series & parallel, parallel means area & mean temp. differences, convention concept of film, overall education of individual film coefficient, radiation, station boltzman law (Mathematical problems included).

6. Stoichiometry: Unit operation and processes, material and energy balances, application of gas laws, combustion calculation, lime kiln performances (Mathematical problems included).

7. Heating Media: Lagging-fuels solids, liquid gases, steam as heating medium properties & uses of steam, steam traps, pressure reducing valves, heating by electricity, steam heated heat exchanges, lagging, condensation.

8. Transportation of Materials: Solids, intermittent & continuous methods in vertical, horizontal & inclined planes. Liquids pipelines, fitting valves, pumps, Gases-fans, blowers-compressor evaporators.

9. Humidification & Dehumidification: Definition of various terms, adiabetic conditions, humidity charts, determination of humidity, methods of increasing and decreasing humidity.

10. Refrigeration and air-conditioning: Compression and absorption types of refrigeration cycles, air conditioning application in pharmacy.

11. Process Variables & Elements of automatic process control: Measurement of variables like flow, liquid levels temp., pressure, vaccum, Introduction to process control systems.

12. Storage of Materials: Solids outdoor storage bins-silo indoor storage in warehouse; liquids storage in tanks, storage of volatile liquids, gases-gas holder cylinder.

13. Packaging of Materials: Function, qualities of package, hazards encountered by package, protection to be given by package containers, closures, foils and pressure packs for pharmaceutical products.

14. Environmental Pollution: An introduction.

Books Recommended:

1. Cooper & Gunn's Tutorial Pharmacy, CBS Publishers & Distributors, Delhi.

2. Leon Lachman & Others, 'The Theory & Practice of Indutrial Pharmacy, Varghese Publishing House, Bombay.

3. Elementary Chemical Engineering, Peter's.

4. Perry- 'Handbook of Chemical Engineering'.