AMSE15 CHEMICAL PROCESS SAFETY

UNIT-1 SAFETY IN THE DESIGN OF CHEMICAL PROCESS PLANTS

1.1. Design principles- Process design development- types of designs, feasibility survey, preliminary design, flow diagrams, piping and instrumentation diagram,
1.2. Batch versus continuous operation,
1.3. Factors in equipment scale up and design, equipment specifications
1.4. Reliability and safety in designing- inherent safety- engineered safety- safety during startup and shutdown- safety checks in the design of the equipment's- reactor safety- safety in erection and commissioning of chemical plants
1.5. Non-destructive testing methods- pressure and leak testing
1.6. Emergency safety devices- scrubbers and flares-new concepts in safety design and operation- Pressure vessel testing standards
1.7. Inspection techniques for boilers and reaction vessels.

UNIT-2 SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS

2.1 Properties of chemicals
2.2 Material Safety Data Sheets
2.3 The various properties and formats used – methods available for property determination.
2.4 Operational activities and hazards- standards operating procedures- safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems
2.5 Effects of pressure, temperature, flow rate and humidity on operations- corrosion and control measures- condition monitoring- control valves- safety valves- pressure reducing valves, drains, bypass valves, inert gases.
2.6 Chemical splashes, eye irrigation and automatic showers.

UNIT-3 SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES

3.1 Types of storage-general considerations for storage layouts
3.2 Atmospheric venting, pressure and temperature relief- relief valve sizing calculations
3.3 Storage and handling of hazardous chemicals and industrial gases,
3.4 Safe disposal methods, reaction with other chemicals, hazards during transportation- pipe line transport- safety in chemical laboratories.
3.5 Safety provisions like level and flow indicators- alarms, trips- protection of stills, columns and towers from lightening- color coding for pipe lines and cylinders.

UNIT-4 CHEMICAL REACTION HAZARDS

4.1 Hazardous inorganic and organic reactions and processes,
4.2 Reactivity as a process hazard, Detonations, Deflagrations, and Runaways, Assessment and Testing strategies,
4.3 Self- heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals,
4.4 Thermo chemical screening, Case studies. Stability and sensitivity tests,

4.5 Classification of materials with explosive potential, Hazard prediction by thermodynamic calculations,

4.6 Prevention and control of explosions and detonations- diluting a release, purging and inserting, venting, explosion relief, flame arrestors, explosion suppression,

4.7 Classification of hazardous areas.

References Books:

1. Ralph King and Ron Hirst, King's Safety in the Process Industries, Arnold, London,1998
2. Industrial Environment and its Evolution and Control: NIOSH
3. Accident Prevention Manual for Industrial Operations: Vol. I & II NSC Chicago
4. Sax N Irvin, Dangerous properties of industrial materials