PROCESS EQUIPMENT

Topic Name	Objectives
Introduction to Tools and Equipment used in Process Industries	1. Describe the appropriate uses of basic hand tools. 2. Describe the appropriate uses of basic power tools. 3. Describe the appropriate uses of sparking and non-sparking tools. 4. Describe hand and power tool safety. 5. Describe the appropriate care of hand and power tools. 6. Identify and describe the appropriate uses of lifting equipment. 7. List types of equipment used in the process industries: • movers (pumps, compressors, conveyor belts, elevators, etc.) • power sources (electric, steam, fuels, hydraulic, pneumatic, etc.) • processors (separation, purification, reaction, etc.) • heating/cooling units (fin fans, chillers, boilers, cooling towers, exchangers, etc.) 8. Using the above list, describe equipment operations common to the process industries. 9. Describe the importance of plant equipment maintenance and predictive/preventive maintenance procedures in the process industries. 10. Discuss different plant approaches to assigning operator performed maintenance tasks. 11. Describe the process technician's role in performing basic maintenance tasks. 12. Describe the process technician's role in preparing equipment for maintenance.
Overview-Piping, Tubing, Hoses & Fittings	1. Describe the purpose of piping, tubing, hoses and fittings in the process industries. 2. Describe the types and uses of piping, tubing, hoses and fittings. 3. Explain the reasons for pressure and temperature limits of hoses and fittings. 4. List and describe or demonstrate various fittings used for pipe, tubes, and hoses and their assembly. 5. Discuss the uses, advantages, and cautions for the types of materials used for piping. 6. Discuss different schedules for piping thickness and ratings on flanges for required service. 7. Discuss selection and sizing criteria as related to pressure, temperature, flow and corrosiveness of fluids. 8. Describe the consequences of improper selection of materials of construction.

PROCESS EQUIPMENT

Topic Name	Objectives
Overview-Piping, Tubing, Hoses & Fittings (cont.)	9. Identify types of connections. 10. Describe the use of sealant compounds. 11. List and describe different hose fittings for utility service (including bottled gases) and the consequences of cross-connections (cross-contamination). 12. Describe the hazards associated with inappropriate cross-connections (e.g., nitrogen to air. 13. Identify and describe plugs, caps and double block and bleed applications. 14. Describe the use and selection of gaskets. 15. Describe the process technician's responsibilities regarding the selection, maintenance and repair of pipe, tubing, hoses, and fittings. 16. Identify typical problems associated with pipe, tubing, hoses, and fittings.
Valves	1. Describe the various types of valves in the process industries. • Globe • Gate • Ball • Check • etc 2. Describe the purpose of common types of valves. • Block • Control • Throttling • Safety 3. Describe the components of valves. 4. Explain the purpose of each component. 5. Describe the selection of valves based on their compatibility with the process (materials of construction, pressure rating, connections, etc.) 6. Describe or demonstrate the operating principles of valves.

PROCESS EQUIPMENT

Topic Name	Objectives
Valves (cont.)	7. Describe safety and environmental concerns associated with valves. 8. Discuss typical procedures associated with valves. 9. Describe the process technician's role in valve operation and maintenance. 10. Identify typical problems associated with valves.
Pumps	1. Describe the purpose of pumps in the process industries. 2. Describe common pump types. 3. Describe the purpose of a pump performance curve. 4. Describe the components of centrifugal pumps (include bearings, seals, packing, etc.). 5. Explain the purpose of each component. 6. Describe or demonstrate the operating principles of centrifugal pumps 7. Identify typical problems associated with centrifugal pumps (cavitation, NPSH –Net Positive Suction Head, etc.). 8. Describe the components of positive displacement pumps (include bearings, seals, packing, etc.). 9. Explain the purpose of each component. 10. Describe the operating principles of positive displacement pumps. 11. Identify typical problems associated with positive displacement pumps. 12. Describe safety and environmental concerns associated with pumps. 13. Identify typical procedures associated with pumps 14. Describe the process technician's role in pump operation and maintenance.
Compressors	1. Describe the purpose of compressors in the process industries. 2. Describe common compressor types. 3. Describe the components of compressors (loading valves, anti-surge protection, seals, etc.). 4. Explain the purpose of each component. 5. Describe the operating principles of compressors. 6. Identify typical problems associated with compressors.

PROCESS EQUIPMENT

Topic Name	Objectives
Compressors (cont.)	7. Describe safety and environmental concerns associated with compressors. 8. Identify typical procedures associated with pumps. 9. Describe the process technician's role in compressor operation and maintenance.
Turbines	1. Describe the purpose of turbines in the process industries. 2. Identify the common types/applications of turbines (steam, gas, etc.). 3. Describe the components of a turbine (including governor control and over-speed trip systems). 4. Explain the purpose of each component. 5. Describe or demonstrate the operating principles of turbines. 6. Describe safety and environmental hazards associated with turbines. 7. Identify typical procedures associated with turbines. 8. Describe the process technician's role in turbine operation and maintenance. 9. Identify typical problems associated with turbines.
Motors and Engines	1. Describe the purpose of motors and engines in the process industries. 2. Identify the common types/applications of motors and engines. 3. Identify major components of engines and electric motors. 4. Explain and/or demonstrate the operating principles of motors and engines. 5. Describe safety and environmental hazards associated with motors and engines. 6. Discuss typical procedures associated with motors and engines. 7. Describe the process technician's role in operation and maintenance of motors and engines. 8. Discuss typical problems associated with motors and engines.
Power Transmission and Lubrication	1. Describe the principles of power transmission and lubrication. 2. Explain the role of power transmission and lubrication in the process industries. 3. Describe the purpose of major transmission components. 4. Describe types of bearings, seals and couplings. 5. Explain the functions of thrust, radial, and vibration bearings.

PROCESS EQUIPMENT

Topic Name	Objectives
Power Transmission and Lubrication (cont.)	6. Describe gears and their uses. 7. Describe safety and environmental hazards associated with transmission and lubrication. 8. Discuss typical procedures associated with transmission and lubrication. 9. Describe the process technician's role in transmission and lubrication procedures 10. Discuss typical problems associated with transmission and lubrication.
Heat Exchangers	1. Describe the purpose of heat exchangers in the process industries. 2. Identify the common types/applications of heat exchangers (including mechanical heat exchangers such as fin fans). 3. Describe the components of heat exchangers. 4. Explain the purpose of each component. 5. Describe or demonstrate the operating principles of heat exchangers. 6. Describe safety and environmental hazards associated with heat exchangers. 7. Discuss typical procedures associated with heat exchangers. 8. Describe the process technician's role in heat exchanger operation, maintenance and efficiency. 9. Identify typical problems associated with heat exchangers. 10. Describe the role of heat exchangers in energy conservation (economizers, etc.).
Cooling Towers	1. Describe the purpose of cooling towers in the process industries. 2. Identify the common types of cooling towers. 3. Define terms associated with cooling towers. 4. Identify the components of cooling towers. 5. Explain the purpose of each component. 6. Describe the operating principles of cooling towers. 7. Describe safety and environmental hazards associated with cooling towers. 8. Discuss the use and purpose of chemical addition to cooling tower water. 9. Discuss typical procedures associated with cooling towers.

PROCESS EQUIPMENT

Topic Name	Objectives
Cooling Towers (cont.)	10. Describe the process technician's role in cooling tower operation and maintenance. 11. Discuss typical problems associated with cooling towers.
Furnaces - Heaters	1. Describe the purpose of furnaces in the process industries. 2. Identify the common types/applications of furnaces. 3. Define terms associated with furnaces. 4. Identify major components of furnaces. 5. Explain the purpose of each component. 6. Explain the operating principles of furnaces. 7. Discuss typical operating/safety procedures associated with furnaces. 8. Describe safety and environmental hazards associated with furnaces (including stack and emissions controls). 9. Describe the process technician's role in furnace operation and maintenance. 10. Discuss furnace operations as it relates to energy efficiency. 11. Identify typical problems associated with furnaces.
Boilers	1. Describe the purpose of boilers in the process industries. 2. Identify the common types/applications of boilers. 3. Define terms associated with boilers. 4. Identify major components of boilers. 5. Explain the purpose of each component. 6. Explain the operating principles of boilers. 7. Discuss typical operating/safety procedures associated with boilers. 8. Describe the process technician's role in furnace and boiler operation and maintenance. 9. Describe the process technician's role in boiler operation, maintenance and operator qualification. 10. Discuss boiler operations as it relates to energy efficiency and emissions. 11. Identify typical problems associated with boilers.

PROCESS EQUIPMENT

Topic Name	Objectives
Filters	1. Describe the purpose of filters in the process industries. 2. Identify the common types/applications of filters. 3. Define terms associated with filters. 4. Identify the components of filters. 5. Explain the purpose of each component. 6. Describe the operating principles of filters. 7. Describe safety and environmental hazards associated with filters. 8. Discuss typical procedures associated with filters. 9. Describe the process technician's role in filter operation and maintenance. 10. Discuss typical problems associated filters.
Dryers	1. Describe the purpose of dryers in the process industries. 2. Identify the common types/applications of dryers. 3. Define terms associated with dryers. 4. Identify the components of dryers. 5. Explain the purpose of each component. 6. Describe the operating principles of dryers. 7. Describe safety and environmental hazards associated with dryers. 8. Discuss typical procedures associated with dryers. 9. Describe the process technician's role in dryer operation and maintenance. 10. Discuss typical problems associated with dryers.
Vessels – Part I – Towers & Columns	1. Describe the purpose of towers and columns in process industries. 2. Describe the common types/applications of towers and columns. 3. Identify the components of towers and columns. 4. Explain the purpose of each component. 5. Explain the operating principles of towers and columns.

PROCESS EQUIPMENT

Topic Name	Objectives
Vessels – Part I – Towers & Columns (cont.)	6. Describe safety and environmental hazards associated with towers and columns. 7. Discuss typical procedures associated with towers and columns operation and maintenance. 8. Describe the process technician's role in towers and columns operation and maintenance. 9. Discuss typical problems associated with towers and columns.
Vessels – Part II – Reactors	1. Describe the purpose of reactors in process industries. 2. Describe the common types/applications of reactors. 3. Identify the components of reactors. 4. Explain the purpose of each component. 5. Explain the operating principles of reactors. 6. Describe safety and environmental hazards associated with reactors. 7. Discuss typical procedures associated with reactors operation and maintenance. 8. Describe the process technician's role in reactors operation and maintenance. 9. Discuss typical problems associated with reactors.
Vessels – Part II – Tanks and Drums	1. Describe the purpose of tanks and drums in process industries. 2. Describe the common types/applications of tanks and drums. 3. Identify the components of tanks and drums. 4. Explain the purpose of each component. 5. Explain the operating principles of tanks and drums. 6. Describe safety and environmental hazards associated with tanks and drums. 7. Discuss typical procedures associated with tanks and drums operation and maintenance. 8. Describe the process technician's role in tanks and drums operation and maintenance. 9. Discuss typical problems associated with tanks and drums.
Flares	1. Describe the purpose of flares in process industries. 2. Describe the common types/applications of flares. 3. Identify the components of flares.

PROCESS EQUIPMENT

Topic Name	Objectives
Flares (cont.)	4. Explain the purpose of each component. 5. Explain the operating principles of flares. 6. Describe safety and environmental hazards associated with flares. 7. Discuss typical procedures associated with flare operation and maintenance. 8. Describe the process technician's role in flare operation and maintenance. 9. Discuss typical problems associated with flare.
Process Diagrams	1. Explain the purpose of diagrams including why/when/where they are used. 2. Identify the major unit sections in flow sequence. 3. Describe symbols used for major process equipment. 4. Identify components on a typical PFD (Process Flow Diagram). 5. Identify components on a typical P&ID (Piping and Instrument Diagram).
Facility Tour (optional)	Discuss course learning objectives on process equipment within a process facility.