

Course Competencies Template – Form 112

GENERAL INFORMATION	
Course Prefix/Number: ETP1230	Course Title: Power Plant Systems
Number of Credits: 2	
Degree Type	<input type="checkbox"/> B.A. <input type="checkbox"/> B.S. <input type="checkbox"/> B.A.S. <input type="checkbox"/> A.A. <input checked="" type="checkbox"/> A.S. <input type="checkbox"/> A.A.S. <input type="checkbox"/> C.C.C. <input type="checkbox"/> A.T.C. <input type="checkbox"/> V.C.C
Date Submitted: 03-30-2011	Effective Year/Term: 2011-1
<input type="checkbox"/> New Course Competency	<input checked="" type="checkbox"/> Revised Course Competency
The above course links to the following Learning Outcomes:	
<input type="checkbox"/> Communication <input checked="" type="checkbox"/> Numbers / Data <input checked="" type="checkbox"/> Critical thinking <input type="checkbox"/> Information Literacy <input type="checkbox"/> Cultural / Global Perspective	<input type="checkbox"/> Social Responsibility <input type="checkbox"/> Ethical Issues <input checked="" type="checkbox"/> Computer / Technology Usage <input type="checkbox"/> Aesthetic / Creative Activities <input type="checkbox"/> Environmental Responsibility
Course Description (limit to 50 words or less):	
<p>This course is designed to familiarize students who are preparing for careers in nuclear power plant maintenance technology with the major systems and components that make up a modern power plant. Students learn the general function and operation of power plant systems and components, the basic electrical systems in a power plant, and the engineered safety features built into nuclear power systems. A.S. degree credit only. (2 hr. lecture)</p>	
Prerequisite(s):	Corequisite(s):

Course Competencies:

Competency 1: The student will demonstrate an understanding of electrical systems in the power plant by:

1. Describing basic plant electrical design to include sources of electrical power, power distribution (AC and DC), effects of work on grounding systems, electrical hazards.
2. Explaining basic electron theory and magnetism.
3. Explaining the theory of operation for the following plant components: motors, generators, transformers, voltage regulators, inverters.
4. Describing instrumentation schemes for control circuitry, ground detection, and protective relaying.
5. Explaining the following aspects of transformers: types, functions, and operations including cooling, fault symptoms and hazards, safety and environmental precautions, and fire protection schemes.
6. Defining and explaining basic electronics concepts and components, including: solid state circuitry, amplifiers, and integrated circuits.

Competency 2: The student will demonstrate understanding of the general function and operation of the basic power plant systems by:

1. Differentiating between Boiling Water Reactor (BWR) and pressurized water reactor (PWR) power plants.
2. Stating the purpose of the following cooling water systems and identifying the normal flow paths for each:
 - Intake Cooling Water (ICW).
 - (Primary) Component Cooling Water (PCCW/CCW).
 - Turbine Cooling Water (TCW).

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3. Stating the purposes of the condenser and describing how it operates, to include
 - Stating the purpose of the Circulating Water System.
 - Explaining how a vacuum is created in the condenser via the condensation process.
 - Describing the Circulating Water System flow path.
 - Describing the steam flow path through the condenser.
 - Stating the adverse effects of seawater leakage into the condensers.
 - Stating how air and non-condensable gases are removed from the condenser.
4. Stating the primary functions of the Chemical and Volume Control System and describing the function of the following Chemical and Volume Control System components:
 - Regenerative Heat Exchanger.
 - Letdown Heat Exchanger.
 - Volume Control Tank.
 - Charging Pumps.
 Identifying the following flow paths:
 - Letdown from the Reactor Coolant System to the Volume Control Tank.
 - Charging from the Volume Control Tank to the Reactor Coolant System.

Competency 3: The student will demonstrate a general understanding of the design and operation of a typical pressurized water reactor (PWR) nuclear plant by:

1. Describing the purpose of the nuclear reactor.
2. Identifying the main components of a nuclear reactor and describing their basic operations within the reactor, including:
 - The structure that houses the nuclear reactor.
 - The component that produces steam to supply the secondary plant.
 - The structure that houses the nuclear reactor.
 - The component that supplies the mechanical power to operate the main generator rotor.
 - The component that produces steam to supply the secondary plant.
3. Identifying the three barriers to the release of radioactivity from a nuclear power plant.
4. Explaining the purpose of the control rods in a nuclear reactor.
5. Stating the functions of the Emergency Diesel Generator System.
6. Stating the purpose(s) of the following Emergency Diesel Generator Subsystems:
 - Governor System.
 - Air Intake and Exhaust System.
 - Turbocharger System.
 - Air Start System.
 - Fuel Oil System.
 - Cooling Water System.
 - Lube Oil System.

Competency 4: The student will demonstrate an understanding of the Engineered Safety Features built into a nuclear power system by:

1. Stating the function of the Reactor Protection System.
2. Stating the function of the Emergency Core Cooling System.
3. Explaining the operation of the following Emergency Core Cooling System components:
 - Refueling Water Storage Tank.
 - Emergency Core Cooling Pumps.
 - Accumulators/Sit.
4. Stating the function of the Containment Spray System and explaining how it operates.
5. Stating the function of the Emergency Feedwater System.
6. Stating the three barriers that protect the public from radiation exposure and essential radiation monitoring functions in power plants.

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Competency 5: The student will demonstrate an understanding of the Main Steam and Steam Bypass Control Systems by:

1. Discussing the functions of the Main Steam System.
2. Identifying the major components of the Main Steam System and their respective primary functions.
3. Discussing the functions of the Steam Dump to Condenser Control System.
4. Explaining how the Steam Dump to Condenser Control System responds to a loss of condenser vacuum.
5. Stating the function of the Pressurizer Pressure & Level Control System.
6. Stating the purpose of the major components of the Pressurizer Pressure & Level Control System:
 - Pressurize.
 - Pressurize Heaters.
 - Pressurize Spray Valves.

Competency 6: The student will demonstrate an understanding of reactor vessel internals by:

1. Describing the function of the following reactor vessel internal components:
 - Reactor Vessel.
 - Reactor Head.
 - Vessel Internals.
 - Lower Internals.
 - Instrumentation Support Assemblies.
 - Upper Internals.
 - Reactor Core.
 - Fuel Assemblies.
 - Fuel Rods.
 - Control Rods.
2. Describing the coolant flow path through the reactor vessel.

Competency 7: The student will demonstrate an understanding of the general purpose and functions of the Shutdown Cooling System by:

1. Stating the function of the Shutdown Cooling/Residual Heat Removal (SDC/RHR) System.
2. Describing the flow path for SDC/RHR.

Competency 8: The student will demonstrate an understanding of the Secondary Systems in a nuclear power generating system by:

1. Stating the function of the condensate system.
2. Using a diagram, tracing the flow path of the condensate from the hot wells to the feed pump suction.
3. Describing the function of the following Condensate System components:
 - Main condensers.
 - LP feedwater heaters.
 - Condensate storage tank.
 - Condensate cleaning system/polisher.
4. Describing the function of the feedwater system.
5. Describing the function of the following feedwater system components:
 - Steam generator (S/G) feed pumps.
 - Feedwater heaters.
 - Feedwater regulating valves.
 - Feedwater regulating bypass valves.
 - Feedwater isolation valves.
 - Start up/auxiliary feed pumps.
 - Steam generator recirc and wet layup pumps.
6. Using a diagram, tracing the feedwater flow path from the S/G feed pumps to the S/Gs.
7. Stating the function of the Secondary Component/Turbine Plant Cooling Water.

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8. Stating the function of the Compressed Air System.
9. Describing how secondary plant corrosion is minimized.
10. Describing the function of the Steam Generator.
11. Describing the operation of the Steam Generator Primary Side to include:
 - Inlet nozzle.
 - Tube bundle.
 - Outlet nozzle.
 - Divider plate.
 - Tube sheet.
12. Describing the operation of the Steam Generator Secondary side to include:
 - Feedwater inlet.
 - Downcomer.
 - Tube bundle.
 - Tube support plates.
 - Moisture separators.
 - Outlet steam flow nozzle.
13. Describing how steam generator level is maintained during power operation.
14. Stating the function of steam generator blow down.

Competency 9: The student will demonstrate an understanding of the Main Turbine and Auxiliaries by:

1. Identifying the components of the main turbine.
2. Explaining how the turbine operates.
3. Listing the auxiliary components and describing their functions in turbine operation.

Competency 10: The student will demonstrate an understanding of the general functions and operation of the Main Power Distribution System by:

1. Listing two major functions of the Main Power Distribution System.
2. Identifying the component systems of the main power distribution system and describing the function of each one in the distribution process.
3. Explaining how power is transmitted and distributed from the power plant.
4. Stating the operating voltages for the following:
 - Main Transformer.
 - Auxiliary Transformer.
 - Startup Transformer.
5. Listing three loads on each 13.5/6.9 kV bus.

Competency 11: The student will demonstrate an understanding of systems used for emergency power and environmental monitoring by:

1. Identifying the emergency power systems and how they function.
2. Discussing how emergency processes are initiated.
3. Identifying the systems and procedures used to monitor the environment for radiation levels.
4. Describing the systems and processes used for post-accident sampling.

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