

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

**ACADEMIC AFFAIRS**

Course Number: ENGY 411 Department: Energy Systems Technology

Course Title: Adv. Heating System Design Semester: Spring Year: 1999

**Objectives/Competencies**

<b>Course Objective</b>	<b>Competencies</b>
1. Describe the operation of a steam radiator.	1. Explain output rating in square feet. 2. Convert from square feet to BTU per hour. 3. Define the term MBh. 4. Explain how to convert steam system to hot water.
2. Identify various types of heat distributing units.	1. Explain principle of operation of cast iron radiators. 2. Explain operation of fin/tube baseboard. 3. Explain operation of type RC cast iron baseboard. 4. Explain operation of convectors. 5. Describe proper location of heat distributing units.
3. Define boiler ratings.	1. Explain the Department of Energy test procedure. 2. Explain Annual Fuel Utilization Efficiency. 3. Define Net IBR ratings. 4. Define the term "Heating Capacity."
4. State reasons for proper location of boiler.	1. Define air requirements for proper combustion. 2. Explain best location for chimney.

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<p>5. Describe safety and relief valves.</p>	<p>3. Explain boiler installation on combustible floors.            4. Describe how to properly connect flue pipe to chimney.</p> <p>1. Define the term ASME.            2. Explain various pressure ratings.            3. Describe capacity ratings.</p>
<p>6. Describe cleaning of internal passages of boiler.</p>	<p>1. Identify contaminants in boiler water.            2. Explain procedure for skimming boiler.            3. Discuss various cleaning compounds.</p>
<p>7. Describe one-pipe steam heating system.</p>	<p>1. Describe the operation of a one-pipe radiator.            2. State the design limitations of a one-pipe system.            3. Define the terms feedwater, steam, condensate.            4. Describe purpose and operation of Hartford logs.</p>
<p>8. Describe air vents in a steam system.</p>	<p>1. Explain purpose of air vents.            2. Describe location of air vents.            3. Explain purpose of adjustable air vent.            4. Describe purpose of quick vent.</p>
<p>9. Describe main piping circuit in a steam system.</p>	<p>1. Define the terms main and trunk.            2. Define the terms dry and wet return.            3. Explain the purpose and direction of pitch.            4. Describe the purpose of the header.</p>
<p>10. Describe the controls in a steam boiler system.</p>	<p>1. Describe the purpose and operation of the low water cut-</p>

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11. Recall steam system piping practices.	<ul style="list-style-type: none"> <li>off.</li> <li>2. Describe the operation of an automatic water feeder.</li> <li>3. Describe the operation of a vacuum air vent.</li> </ul>
12. State procedure for sizing a steam system.	<ul style="list-style-type: none"> <li>1. Explain reason for reaming pipes.</li> <li>2. Explain which pipes must be insulated.</li> <li>3. Define specifications for overall system pitch.</li> <li>4. Explain procedure for dividing truck into circuits.</li> </ul>
13. State general operation of a forced hot water heating system.	<ul style="list-style-type: none"> <li>1. Explain heat loss calculation procedure.</li> <li>2. Explain how to select radiators.</li> <li>3. Select proper size boiler.</li> <li>4. Explain layout of piping circuit.</li> <li>5. Select proper pipe sizes.</li> </ul>
14. Describe removal of air from a hot water system.	<ul style="list-style-type: none"> <li>1. Explain principles of heated water.</li> <li>2. Explain function of air cushion tank.</li> <li>3. Explain operation of diaphragm expansion tank.</li> </ul>
15. Describe various valves in a hot water system.	<ul style="list-style-type: none"> <li>1. Explain operation of automatic air vent.</li> <li>2. Explain operation of air scoop.</li> <li>3. Explain operation of spiro vent.</li> <li>4. Explain how to purge a system.</li> </ul>
15. Describe various valves in a hot water system.	<ul style="list-style-type: none"> <li>1. Explain function of backflow preventer.</li> <li>2. Explain operation of pressure reducing valve.</li> <li>3. Explain location and purpose of balance valves.</li> </ul>

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<p>16. Describe the concept of design water temperature.</p>	<ol style="list-style-type: none"> <li>4. Explain location and function of flow control valve.</li> <li>5. Explain function of radiator valve.</li> <li>1. Define what design water temperature means.</li> <li>2. Explain how system temperature related to system pressure.</li> <li>3. Explain reasons for maintaining boiler temperature.</li> <li>4. Explain cold start boiler operation.</li> </ol>
<p>17. Describe components in a hot water heating system.</p>	<ol style="list-style-type: none"> <li>1. Describe function of altitude gauge.</li> <li>2. Describe the operation of a one-pipe (Venturi) fitting.</li> <li>3. Explain function of dip tube.</li> <li>4. Explain function of circulating pump.</li> </ol>
<p>18. Identify types of forced hot water heating systems.</p>	<ol style="list-style-type: none"> <li>1. Explain operation of series loop system.</li> <li>2. Explain operation of one-pipe system.</li> <li>3. Explain operation of two-pipe system.</li> <li>4. Explain operation of radiant system.</li> </ol>
<p>19. State function of circulating pump.</p>	<ol style="list-style-type: none"> <li>1. Describe principle of operation of pump.</li> <li>2. Explain gallon per minute rating.</li> <li>3. Explain feet of head rating.</li> <li>4. Describe parts of a pump curve.</li> </ol>
<p>20. Describe methods of zoning hot water systems.</p>	<ol style="list-style-type: none"> <li>1. Explain how to zone with electric zone valves.</li> <li>2. Explain zoning with separate circulators.</li> <li>3. Describe procedure for balancing a system.</li> </ol>

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21.Explain how to size a series loop hot water heating system.	<ol style="list-style-type: none"> <li>1. Describe how to select the baseboard.</li> <li>2. Describe how to select boiler.</li> <li>3. Calculate gallon per minute requirements.</li> <li>4. Calculate proper pump size.</li> <li>5. Calculate proper pipe sizes.</li> </ol>
22.Explain how to size a one-pipe hot water heating system.	<ol style="list-style-type: none"> <li>1. Select proper heat distributing units.</li> <li>2. Size piping circuit using Venturi fittings.</li> <li>3. Determine gallon per minute requirements.</li> <li>4. Select pump gpm and feet of head.</li> </ol>
23.Explain operation of in-floor radiant heating system.	<ol style="list-style-type: none"> <li>1. Determine net IBR requirements.</li> <li>2. Calculate BTVH heat loss per square foot.</li> <li>3. Determine floor temperature requirements.</li> <li>4. Select proper tube spacing.</li> </ol>
24.Explain details of concrete radiant floor heating system.	<ol style="list-style-type: none"> <li>1. Describe insulating the slab.</li> <li>2. Explain attachment of tubing.</li> <li>3. Calculate water temperatures and flow rates.</li> <li>4. Describe floor covering limitations.</li> </ol>
25.Explain operation of tankless water heaters.	<ol style="list-style-type: none"> <li>1. Describe position in boiler.</li> <li>2. Describe operation of mixing valve.</li> <li>3. Explain purpose of flow regulating valve.</li> <li>4. Describe high temperature/tempered water circuits.</li> </ol>

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26.Explain operation of indirect water heaters.	<ol style="list-style-type: none"> <li>1. Explain piping circuit from boiler.</li> <li>2. Describe thermostatic control.</li> <li>3. List advantages over tankless heaters.</li> </ol>
27.Explain selection of water heaters.	<ol style="list-style-type: none"> <li>1. Calculate gallon per minute requirements.</li> <li>2. Determine recovery rates.</li> <li>3. Determine storage capacity.</li> </ol>