A. **TITLE**: Heating and Plumbing Principles and Practices 1

B. **COURSE NUMBER**: ACHP171  
**SHORT TITLE**: Heating and Plumbing

C. **CREDIT HOURS**: 7

D. **WRITING INTENSIVE COURSE**: (OPTIONAL) No

E. **LENGTH OF COURSE**: 15 weeks (including final)

F. **SEMESTER(S) OFFERED**: Fall

G. **HOURS OF LECTURE**: 4 hrs. of lecture per week.  
9 hrs. of lab per week.

H. **CATALOGUE DESCRIPTION**: The fundamentals of heating equipment and practices; selection, use and care of hand and power tools; piping fabrication of copper, steel, cast iron and plastic pipe; oil burner installation and service; drainage, waste and vent plumbing; basic sheet metal practice; well pumps and accessories.

I. **PRE-REQUISITES**: None  
**CO-COURSES**: MATH 101 or 106, ENGL 101, and CONS 151

J. **GOALS (STUDENT LEARNING OUTCOMES)**:  
By the end of the course, the student should be able to:

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<th>Course Objective</th>
<th>Institutional SLO</th>
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| Install a half bathroom using proper practices in a group setting | 3. Professional competence  
4. Inter/Intra personal skills |
| Install a functional single zone oil boiler in a group setting | 3. Professional competence  
4. Inter/Intra personal skills |
| Show proper usage of hand and power threading tools | 3. Professional competence |
| Flare and solder copper pipe and tubing | 3. Professional competence |
| Create basic sheet metal objects | 3. Professional competence |
| Design proper DWV and supply water systems | 2. Critical thinking  
3. Professional competence |
K. **TEXTBOOK:** Residential Construction Academy: Plumbing
   Residential Construction Academy: Heating
   Sheet Metal
   ACHP171 Lab and Reference Manual

L. **REFERENCES:** Manufacturer installation and service manuals, ASHRAE Fundamentals.

M. **EQUIPMENT:** Various heating and plumbing equipment, combustion analyzer, velometer, multimeter, ammeter and monometer.

N. **GRADING METHOD:** (P/F, A-F, etc.): A-F.

O. **MEASUREMENT CRITERIA/METHODS:** One half of grade will come from completed lab projects. One half of grade will come from lecture quizzes and exams.

P. **DETAILED TOPICAL OUTLINE:**

1. **Layout and installation of half-bathroom**
   a. Select proper location of DWV and supply piping;
   b. Install leak-free fixtures;
   c. Provide a detailed material list.

2. **Replacing fixtures**
   Diagnostic check of existing fixture reliability;
   d. Understanding and applying manufacturer data sheets for fixture replacement;
   e. Job cost estimating.

3. **Water heater installation and service**
   f. Calculating hot water demand;
   g. Sizing of gas, oil or electrical supply lines;
   h. Determining flue connections as required;
   i. Use of multimeter and manufacturer wiring diagrams for troubleshooting.

4. **Sheet metal pattern drafting and fabrication**
   j. Basic sheet metal patterns;
   k. Construction of at least (2) sheet metal projects;
   l. Demonstrate ability with sheet metal tools.

5. **Oil fired equipment controls**
   m. Ignition transformers;
   n. Primary Controls;
   o. Cad cell sensors;
   p. Fan and limit control.

6. **Hydronic system installation**
q. Boiler and sundry installation;
r. Fuel and flue sizing;
s. Supply and return piping sizing for a single zone;
t. Combustion efficiency calculation;
u. Complete material list.

7. Well pump installation
   v. Shallow well, single pipe;
w. Shallow well, (2) pipe;
x. Submersible pumps;
y. Determining pump efficiency.

Q. LABORATORY OUTLINE:
   1. Design and install a half-bath
   2. Design and install a single zone oil boiler system.
   3. Install an oil, gas or electric water heater.
   4. Post-job estimate and job cost out for above 3 installations.
   5. Combustion testing and troubleshooting on 3 lab units.
   6. Electrical testing and multimeter usage on lab breadboards.
   7. Sheet metal pattern drafting and fabrication, using basic methods.
   8. Testing and inspecting plumbing systems;
   9. Replacing fixtures;
   10. Water heater installation and service;
   11. Sheet metal pattern drafting and fabrication;
   12. Oil fired equipment controls;
   13. Hydronic system installation;