LESSON PLAN 19

**DYSART UNIFIED - CTE 2013-2014**

COURSE: **Architectural Design Drafting**

PROGRAM: **Signature Architecture Program**

TEACHER(S): **Scott Thomas, M.Ed., MCCTE, CD**

CURRICULUM UNIT/TITLE: Introduction to Architectural Design Drafting

LESSON TITLE: Heating, Ventilation, and Air Conditioning (Applied Math)

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| **STANDARDS AND OBJECTIVES** | |
| CTE PROGRAM STANDARD - MEASUREMENT CRITERIA | 8.6 Draft an HVAC plan locating HVAC diffusers, outlets, equipment |
| COMMON CORE STANDARDS | 1. CCSS.Math.Practice.MP1   Make sense of problems and persevere in solving them.  Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.   1. CCSS.Math.Practice.MP2   Reason abstractly and quantitatively.  Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.   1. CCSS.Math.Practice.MP3   Construct viable arguments and critique the reasoning of others.  Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.   1. CCSS.Math.Practice.MP4   Model with mathematics.  Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.   1. CCSS.Math.Practice.MP5   Use appropriate tools strategically.  Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.   1. CCSS.Math.Practice.MP6   Attend to precision.  Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions. |
| OBJECTIVES | Lesson 19 - Heating, Ventilation, and Air Conditioning (Applied Math)  Time Estimate: to be determined by student needs.  Lesson Objectives  • Explain that the National Energy Conservation Code regulates the exterior envelope and the selection of equipment that affects the consumption of power.  • Identify code requirements related to heating and cooling equipment and duct systems.  • Describe (in Writing) the basic concept of central forced-air systems. (CCSS.ELA WHST.11-12.4)  • Explain the heating cycle of a central forced-air system. (Applied Math)  • Explain (in Writing) how a cooling system works, and the two principles that make cooling possible.  • Describe (in Writing) how to provide proper duct spacing for forced-air heating and cooling systems. (CCSS.ELA WHST.11-12.4)  • Describe the basic concept of hot water systems. (Applied Math)  • Identify basic HVAC symbols.  • Explain the basic function of a heat pump, cite basic residential sizes, and specify ideal locations.  • Contrast (in Writing) zonal and central heating systems and list the advantages and disadvantages of each.  • Identify and compare the two types of zone heaters.  • Articulate (in Writing) the process of a radiant system and understand how it can generate cost savings compared to conventional convective systems.  • Cite the factors that contribute to effective control and placement of thermostats. (Applied Math)  • Cite (in Writing) sources of indoor pollution and possible remedies to reduce the amount of pollution.  • Describe (in Writing) the need and function of an air-to-air heat exchanger.  • Specify both recommended air changes per hour, as well as identify the volume of recommended air movement.  • List the code requirements for HVAC exhaust systems.  • Calculate the volume of air to be moved for a given room or home. (Applied Math)  • Identify (in Writing) the advantages and disadvantages of a central vacuum system. (Applied Math)  • Demonstrate the origin of the degree-day method to estimate annual energy consumption. (Applied Math)  • Define (in Writing) basic HVAC terminology (see list below).  • Fill out a residential heating and cooling data sheet.  • Know basic steps used to prepare HVAC drawings.  • Distinguish between single- and double-line HVAC plans.  • Identify (in Writing) what both detail and section drawings illustrate, and what scales are typically used.  • Describe how schedules are used in HVAC drawings, and cite the kind of information included in schedules.  • Describe (in Writing) how HVAC CAD software configures duct layouts.  • Describe how CAD pictorials, known as graphic models, aid in the design of duct layouts. |
| CHECKLIST OF ESSENTIAL CONTENT -IDEAS TO BE COVERED: (Lesson summary) | * Explain that the National Energy Conservation Code regulates the exterior envelope and the selection of equipment that affects the consumption of power.   • Identify code requirements related to heating and cooling equipment and duct systems.  • Describe (in Writing) the basic concept of central forced-air systems. (Applied Math)  • Explain the heating cycle of a central forced-air system. (Applied Math)  • Explain (in Writing) how a cooling system works, and the two principles that make cooling possible.  • Describe (in Writing) how to provide proper duct spacing for forced-air heating and cooling systems.  • Describe the basic concept of hot water systems. (Applied Math)  • Identify basic HVAC symbols.  • Explain the basic function of a heat pump, cite basic residential sizes, and specify ideal locations.  • Contrast (in Writing) zonal and central heating systems and list the advantages and disadvantages of each.  • Identify and compare the two types of zone heaters.  • Articulate (in Writing) the process of a radiant system and understand how it can generate cost savings compared to conventional convective systems.  • Cite the factors that contribute to effective control and placement of thermostats. (Applied Math)  • Cite (in Writing) sources of indoor pollution and possible remedies to reduce the amount of pollution.  • Describe (in Writing) the need and function of an air-to-air heat exchanger.  • Specify both recommended air changes per hour, as well as identify the volume of recommended air movement.  • List the code requirements for HVAC exhaust systems.  • Calculate the volume of air to be moved for a given room or home. (Applied Math)  • Identify (in Writing) the advantages and disadvantages of a central vacuum system. (Applied Math)  • Demonstrate the origin of the degree-day method to estimate annual energy consumption. (Applied Math)  • Define (in Writing) basic HVAC terminology (see list below).  • Fill out a residential heating and cooling data sheet.  • Know basic steps used to prepare HVAC drawings.  • Distinguish between single- and double-line HVAC plans.  • Identify (in Writing) what both detail and section drawings illustrate, and what scales are typically used.  • Describe how schedules are used in HVAC drawings, and cite the kind of information included in schedules.  • Describe (in Writing) how HVAC CAD software configures duct layouts.  • Describe how CAD pictorials, known as graphic models, aid in the design of duct layouts. |

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| **LESSON CONTENT** | | |
| BELL WORK | None… | |
| KEY VOCABULARY | Heating, ventilation, and air-conditioning, returns, supplies, British thermal units, the cubic volume of air. | |
| TEACHER ACTIONS/ACTIVITIES:  (include instructions with all resources) | | STUDENT ACTIONS/ACTIVITIES:  (include instructions with all resources) | |
| Lecture, Demonstration, Small Group Instruction, Individual Instruction  **Architecture: Residential Drafting and Design** by  Wm. Scott Thomas, M.Ed., MCCTE, CD, 11th Edition, Goodheart-Willcox Publisher, Inc. | | Sketches, Working Drawings, Hands-On Projects related to subject matter  **Architecture: Residential Drafting and Design** by  Wm. Scott Thomas, M.Ed., MCCTE, CD, 11th Edition, Goodheart-Willcox Publisher, Inc. | |

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| ALIGNED COMMON CORE ACTIVITY  (include instructions with all resources) | All aligned common core activities will vary in scope and complexity depending upon the needs of individual students. Instructions and resources for all assignments can and will vary also because of the needs of individual students. |
| CHECK FOR UNDERSTANDING - ASSESSMENT | Sketches, working drawings, tests, and quizzes  **“Assignment 1 / Project 1” to be used for Lesson Plans 2–30.… This is a long-term architectural assignment/assessment.** |
| CLOSURE ACTIVITY | Detailed Review of Lesson Materials and Subject Matter |

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| **LESSON RESOURCES** | |
| BOOKS/TEXTS  SUPPLEMENTALS  RESOURCES | **Architecture: Residential Drafting and Design** by Wm. Scott Thomas, M.Ed., MCCTE, CD, 11th Edition, Goodheart-Willcox Publisher, Inc. |
| HANDOUTS  ACTIVITIES  INSTRUCTIONS  RUBRICS | * Architectural sketches per subject matter * CAD design drawings * Manual technical sketching * AIA / IRC / UBC * HVAC plan |
| SUPPLIES NEEDED | CAD stations, paper, fountain pen/pencil |
| NOTES | The aligned common core activities will vary in scope and complexity, based upon the individual needs of students. This includes the instructions per assignment and all resources needed to complete these assignments.  Assignments will vary in scope and complexity depending upon the needs of individual students.  The length of this lesson can and will vary depending upon student needs. |