ASHRAE Course Library

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Course Descriptions

The Fundamentals of HVAC Systems

A thorough introduction to how HVAC systems control temperature, air quality, and air circulation in a conditioned space.
On-demand, 13 interactive courses

- Online course reader
- Online self-assessment
- Completion certificate for 35 PDH
- Separate Inch-Pound and SI / metric versions are available.

Ideal for:

- Recent engineering graduates working in HVAC&R
- Engineers entering HVAC&R from another area
- Architects
- Technicians
- Construction or building management professionals wanting to increase their knowledge of HVAC systems.

After completing this course, you will understand:

- The objectives to be achieved by an HVAC system in terms of environmental control.
- The description of a system - including primary equipment, means of distribution, space and load determination, and operating strategy.
- The basic function of components that form HVAC systems.
- The layout and functioning of common HVAC systems, including all-air systems, air-water systems, and all-water systems.
- The strategies for operating systems and their basic means of control.
- Identifying the most suitable type of system for different types of applications.

Learning Objectives:

The 13 courses help you to understand

- Introduction to air-conditioning, the environmental factors influencing comfort, and how to determine and prioritise system design objectives
- How to understand and use simple psychrometric charts, description of basic system components and operation of the economizer cycle
- Understanding the factors determining thermal comfort and the comfort envelope to design systems that operate within acceptable ranges
- Understanding the types, sources and effects of air contaminants and how to control them, and the basic concepts of ASHRAE Standard 62.1
- How to define zones and place thermostats effectively
- Calculating and maintaining mixed air temperature with Single-zone Air Handlers and Refrigeration Equipment
- How to describe and sketch the common all-air systems, and discriminate between the advantages and disadvantages of each
- Components, strengths and weaknesses of hydronic systems, the effects of varying water flow and considerations for effective ventilation
- General operation and layout of Steam Systems and Water Systems : Hot Water, Chilled Water and Condenser Water Systems
- The value of Central versus Distributed Plants, the significance of pressure in boilers, the operation of chillers and cooling tower performance
- Understanding types of controls and control loops, DDC point types and protocol to ensure communication between DDC systems
- How to save energy in operation and design of HVAC systems, overview of ASHRAE Standard 90.1, Heat Recovery and Control of Building Pressure
- Radiant Heating and Cooling, Thermal Storage, Room Air Distribution and Humidity Control

Courses:

Each of the 13 Courses are available separately.

1. Introduction to HVAC Design
2. HVAC Systems: An Introduction

3. HVAC Systems: Thermal Comfort
4. HVAC Systems: Ventilation & IAQ
5. HVAC Systems: Intro to Zones
6. HVAC Systems: Single-Zone Handlers & Unitary Equipment
7. HVAC Systems: Multiple-Zone Air Systems
8. HVAC Systems: Hydronic Systems
9. HVAC Systems: Hydronic System Architecture
10. HVAC Systems: Central Plants ye
11. HVAC Systems: Controls
12. HVAC Systems: Energy Conservation Measures
13. HVAC Systems: Special Applications

Fundamentals of HVAC Control Systems

PDH Value: 47 PDH

Description:

A practical guide to the principles and characteristics of controls, and how to apply them in the use, selection, specification and design of controls systems.

Ideal for:

Mechanical engineers, architects, mechanical equipment manufacturers, building plan examiners, field inspectors, construction contractors, mechanical equipment operators, mechanical contractors, and mechanical equipment maintenance personnel.

Learning objectives

After completing these courses, you will understand:

- Control theory and how to evaluate, select, position and sequence the appropriate type of control
- The electrical knowledge needed to understand controls and the use of electrical circuit drawings
- The various types of valves and dampers, and their selection, installation and operation
- Terminology and attributes of sensors, the selection of moisture sensors, pressure, flow, and auxiliary devices
- Self-powered and system-powered controls
- Electric controls, control diagrams and control logic
- The components of pneumatic systems and control applications diagrams
- Wiring conventions, application-specific electronic controllers and how to use them in HVAC applications
- The use of written specifications, schedules, and drawings to clearly identify what is to be installed, how it is to be installed, and how it is expected to operate
- Direct Digital Controls (DDC) components, their inputs and outputs, and the programming of DDC routines
- DDC Networks and Protocols
- DDC Specification, Installation and Commissioning

Full details:

A practical guide to the principles and characteristics of controls, and how to apply them in the use, selection, specification and design of controls systems.

The course presents control theory, basics of electricity, input and output devices, the influence of input and output characteristics on control possibilities and performance, and control diagrams. This serves as a basis for understanding direct digital control (DDC), the most commonly used control today. Pneumatic and electric controls are also included to complete the picture and deal with existing systems which have to be replaced, modified, and maintained.

After completing this course, you will understand:

- Control theory and how to evaluate, select, position and sequence the appropriate type of control
- The electrical knowledge needed to understand controls and the use of electrical circuit drawings
- The various types of valves and dampers, and their selection, installation and operation
- Terminology and attributes of sensors, the selection of moisture sensors, pressure, flow, and auxiliary devices
- Self-powered and system-powered controls
- Electric controls, control diagrams and control logic
- The components of pneumatic systems and control applications diagrams
- Wiring conventions, application-specific electronic controllers and how to use them in HVAC applications
- The use of written specifications, schedules, and drawings to clearly identify what is to be installed, how it is to be installed, and how it is expected to operate
- Direct Digital Controls (DDC) components, their inputs and outputs, and the programming of DDC routines

- DDC Networks and Protocols
- DDC Specification, Installation and Commissioning

Fundamentals of HVAC control systems includes:

- 12 months on-demand access to a full online course comprised of 12 interactive courses
- Online course reader
- Online self-assessment
- Completion certificate for 35

The 12 courses from this course are also available as short courses

1. HVAC Controls: Introductions to HVAC Control Systems
2. HVAC Controls: Basics of Electricity
3. HVAC Controls: Control Valves and Dampers
4. HVAC Controls: Sensors and Auxiliary Devices
5. HVAC Controls: Self- and System-Powered Controls
6. HVAC Controls: Electric Controls
7. HVAC Controls: Pneumatic Controls
8. HVAC Controls: Analog Electronic Controls
9. HVAC Controls: Control Diagrams and Sequences
10. HVAC Controls: DDC Introduction to Hardware and Software
11. HVAC Controls: DDC Networks and Protocols
12. HVAC Controls: DDC Specification, Installation and Commissioning

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Introduction to DDC (Digital Controls) for HVAC Description

A practical introduction to Direct Digital Controls systems components and interoperability to specify, design and operate HVAC systems that meet client air quality and energy performance requirements.

Ideal for:

System operators**,** Mechanical engineers, architects, mechanical contractors, and system owners and operators

Learning objectives:

After completing these courses, you will understand:

- Direct Digital Control (DDC) systems components, their inputs and outputs, and the programming of simple DDC routines.
- Interoperability of controllers, network and data protocols and the foundations of BACnet® and LonWorks®.
- How to specify and design DDC systems to match client requirements, and energy performance for heating and cooling.

Details:

A practical introduction to Direct Digital Controls (DDC), the most common control system for HVAC systems. Understand DDC system components, interoperability and protocols to specify, design and operate HVAC systems that meet air quality and energy performance requirements

After completing this course, you will understand:

- Direct Digital Control (DDC) systems components, their inputs and outputs, and the programming of simple DDC routines
- Interoperability of controllers, network and data protocols and the foundations of BACnet® and LonWorks®
- How to specify and design DDC systems to match client requirements, and energy performance for heating and cooling

This DDC course includes:

- On-demand, interactive course of 3 online short courses
- Online course content
- Online assessment
- Completion certificate for 12.5 PDHs or 1.25 CEUs

These courses are made up of these 3 subjects:

1. DDC Introduction to Hardware and Software - Introduction to Direct Digital Control (DDC) components, their inputs and outputs, and the programming of DDC routines

2. DDC Networks and Protocols - Understanding interoperability of controllers, network and data protocols with an introduction to BACnet® and LonWorks®

3. DDC Specification, Installation and Commissioning - How to specify and design DDC systems to match client requirements and a demonstration of energy performance for heating and cooling.

Fundamentals of Sustainable Buildings and High Performance Systems Design

A thorough introduction to green design practices, benefits, new green building ideas, and an overview of the architectural decisions and their impact on sustainable and green project goals.

PDF Value: PDH: 31

Designed for:

- Recent engineering graduates working in HVACR
- Engineers entering HVACR from another area
- Technicians
- Architects

After completing this course, you will understand:

- The key concepts of green design
- The source, phases and importance of commissioning
- The various ways in which the various LEED credits affect the HVAC engineer
- The impacts some architectural decisions have and how these decisions affect sustainable/green project goals
- The importance of maintaining thermal conditions and generating new building design ideas.
- Environmental benefits of green design
- The concepts related to water-conservation, water heating and the different water systems
- How building control increases efficiencies and help in achieving LEED credit points

Course description:

- On-demand, interactive course of 8 courses (“short courses”)
- Online course reader with easy-to-print PDF files
- Online self-assessment.

Courses:

		PDHs
1)	The Basics of Sustainable Design	5
2)	Commissioning	3
3)	LEED Guidance	3
4)	Integrated Design	5
5)	Indoor Environmental Quality	4.5
6)	Energy Conservation	7
7)	Plumbing and Fire Protection Systems	1
8)	Building Controls	2.5

Every course includes:

- Reading assignment
- Learning activities
- Lesson summary
- Course exam

Learning Objectives:

The 8 online courses help you to understand:

- The differences between green and sustainable design, the components of a successful green project, the green building rating systems available and the pros and cons of each system and the justification of the system.
- The five main phases of commissioning, the importance of documentation to commissioning, the interaction of the commissioning agent with the normal site supervision during construction, and the engineer’s role in construction quality.
- The five main program areas that LEED summarizes, the key points in each program area, particularly as they apply to ASHRAE members, the various EA credits, and the ASHRAE standard for thermal and lighting control.
- The cost implications when choosing a site, the impact site orientation has on the use of natural resources, the basis of integrated design and how it affects project costs, and the concept of night precooling.

- The five main areas that comprise "indoor environmental quality" (IEQ), the relationship between indoor air quality (IAQ) and the outdoor air quality, and how HVAC designs influence this interaction, and the new ideas on design of healthy buildings.
- The environmental benefits of using renewable energy sources, passive versus active renewable energy, and the types of solar energy utilization.
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- Where sustainable design can be implemented into plumbing systems, the effect that other disciplines can have on green design, and the importance of conserving water and the positive affects it can have on our planet.
- How building controls may benefit the environment, the importance of building controls in providing good building IEQ, and help a project achieve LEED credit points and help in continued efficient operation of the building after occupancy.

Fundamentals of ASHRAE Standard 90.1

Course description:

The Fundamentals of Standard 90.1 ASHRAE eLearning System includes:

- On-demand, interactive course of 15 online courses
- Essential electronic extracts of ANSI/ASHRAE/IESNA Standard 90.1-2004
- Essential electronic extracts of Standard 90.1-2004 User's Manual
- Online Assessment
- Completion certificate for 35 PDH

A practical guide to the application of ANSI / ASHRAE / IESNA Standard 90.1-2004 to help you understand and comply with the minimum energy efficiency standard for all non-residential buildings and all residential buildings greater than three stories in height in the USA.

This course is a US Green Building Council Approved Education Provider Program and provides a firm foundation for LEED™.

Ideal for:

- Consulting or specifying engineers
- Utility Engineers
- Energy Engineers & Project Managers
- Application & Field Engineers

This course will show you how to:

- Apply the detailed requirements of Standard 90.1 in the design and construction of energy efficient buildings.
- Make best use of the available resources, including the Standard itself, Standard 90.1's User's Manual, EnvStd software and other tools.
- Complete the documentation provided with the User's Manual in the correct manner to gain compliance.
- Translate the principles of the Standard to local and state adaptations

The standard 90.1 courses:

1) ANSI/ASHRAE/IESNA Standard 90.1: Scope, Application and Administration
2) Building Envelope – General and Mandatory Provisions
3) Building Envelope – Prescriptive Requirements
4) Building Envelope – Tradeoff Procedure
5) HVAC – General Information and Simple Approach Option
6) HVAC – Mandatory Provisions I
7) HVAC – Mandatory Provisions II
8) HVAC – Prescriptive Requirements I
9) HVAC – Prescriptive Requirements II
10) Service Water Heating
11) Power and Other Equipment
12) Lighting – General and Mandatory Provisions
13) Lighting – Interior Power
14) Energy Cost Budget Method
15) Building Performance Rating Method

Learning objectives:

The 15 online courses help you to understand:

1) **ANSI / ASHRAE / IESNA Standard 90.1: Scope, Application and Administration**
The types of buildings the Standard applies to, who issues interpretations and rulings on it, the approaches for complying, and how it typically enforced when it is adopted as code.

2) **Building Envelope – General and Mandatory Provisions**
How to determine the space conditioning category(s) that apply to your building and ways to comply with the building envelope requirements

3) **Building Envelope – Prescriptive Requirements**
Why the Standard has different criteria for different classes of construction and how to use the building envelope prescriptive requirements to comply, including criteria specifications for below-grade walls, insulation of metal building walls and roofs, single-rafter roofs, cool roofs, mass walls. How to specify the minimum R-value and maximum U-factor for building envelope components to comply.

4) **Building Envelope – Tradeoff Procedure**
How to use the EnvStd software to demonstrate compliance with the building envelope requirements.

5) **HVAC – General Information and Simple Approach Option**
How to apply the Standard to HVAC systems for new buildings, additions and alterations to existing buildings, and the buildings types and HVAC systems that may use the simplified approach option.

6) **HVAC – Mandatory Provisions I**
How to use HVAC system equipment efficiency tables, determine when load calculations are required and list what information is needed. How to determine requirements for zone thermostats and off-hour controls, list ventilation system controls and high occupancy ventilation control strategies.

7) **HVAC – Mandatory Provisions II**
How to apply the requirements for piping and ductwork insulation and sealing

8) **HVAC – Prescriptive Requirements I**
How to determine when airside and waterside economizers are required, how to apply economizer control strategies, minimize simultaneous heating and cooling. Understand control strategies for heat pump systems and two-pipe hydronic systems, the controls required to prevent reheating when dehumidifying a space and how to apply the Standard when humidifying a space.

9) **HVAC – Prescriptive Requirements II**
How to understand and apply fan power limits; hydronic system variable flow requirements and temperature reset; heat rejection equipment power limitations and speed control; when to apply energy recovery; requirements for kitchen hoods; radiant heating systems; hot gas bypass limitations.

10) **Service Water Heating**
Service water heating requirements covered by the Standard, including equipment, piping and system controls.

11) **Power and Other Equipment**
Describe energy efficient electrical distribution systems that minimize voltage drops to limits specified by the Standard, and the building power distribution documentation requirements of the Standard.

12) **Lighting – General and Mandatory Provisions**
Understand the scope of the lighting portion of the Standard, which lighting controls are required, when automatic shutoff controls are required, the requirements for exit signs and how to determine and calculate exterior lighting requirements.

13) **Lighting – Interior Power**
Describe the building area and space-by-space compliance methods for interior lighting, measure spaces and areas correctly for each method.

14) **Energy Cost Budget Method**
Assemble the documentation to prove compliance with the Standard, list the types of trade-offs allowed when using the energy cost budget (ECB) method; how the ECB method is used when improving an existing building; how it is used when a building contains unfinished tenant spaces. How to describe a standard HVAC system and determine which utility rate to use.

15) **Building Performance Rating Method**
Understand the Building Performance Rating Method, its energy components, how the mandatory provisions apply, documentation requirements, the differences to the EECB method and it offers credits for that the ECB method does not.

Fundamentals of ASHRAE Standard 62.1 Ventilation and Acceptable Indoor Air Quality

Course description:

Based on the newly released 2007 edition of Standard 62.1

- On-demand, interactive course of 15 online courses
- Essential electronic extracts of ASHRAE Standard 62.1
- Online Assessment
- Completion certificate for 35 PDH

A practical guide to applying the industry standard for the design and operation of ventilation systems to provide acceptable indoor air quality.

Properly designed ventilation systems are essential for the well-being of building occupants, to minimize adverse health effects and improve productivity of workers and students. Standard 62.1, Ventilation and Acceptable Indoor Air Quality, is the industry standard for the design and operation of ventilation systems to provide acceptable indoor air quality.
This course is a practical guide to applying the standard's ventilation rates and demonstrates the regulatory application to new buildings, and additions and changes to existing buildings.
It demonstrates the interaction of ventilation with heating and air-conditioning systems and how various parts of a building affect indoor air quality. This understanding will help you design, construct, operate and maintain buildings with acceptable indoor air quality.

Ideal for:

- Architects,
- HVAC Designers
- HVAC Facility Managers and Operating Staff
- Equipment Design, Application and Sales Engineers
- Mechanical Contractors
- Code Officials

Learning objectives:

After completing these courses, you will understand:

- The requirements of ASHRAE 62.1-2007 for design, construction, building operation and maintenance
- How to apply the requirements in a hypothetical new building and an existing building being retrofitted
- The different approaches to HVAC design that result in different quantities of outside air at the outside air intake
- The requirements for ventilation and air-cleaning system design, installation, commissioning, and operation and maintenance
- The mandatory language of ventilation standards

Course titles

1. Purpose - Why we ventilate buildings
2. Scope, Definitions, and Example Buildings - What is acceptable outdoor air quality
3. Outdoor Air Quality - What is in the air outside
4. Outdoor Air Intakes and Exhaust - How to get good air inside and bad air outside
5. Natural Ventilation and Exhaust - The historical approach to ventilation
6. Indoor Air Quality Procedure - The scientific approach to ventilation
7. Ventilation Rate Procedure (VRP) - The current engineering approach to ventilation
8. VRP Multiple Zones - Ventilation for multi-purpose and large buildings
9. Re-circulating and Treating Indoor Air - Good air separation makes good neighbors
10. VRP Multiple Zones VAV - An approach to saving fan energy
11. VRP Multiple Zones General Case - Complex ventilation systems
12. Varying Operating Conditions - Do we need all this air all the time?
13. Moisture and Mold Control - What's growing in there?
14. Construction, Startup, and Maintenance - Now that we have plan, what do we do next?
15. Documentation - What we did and why

Refrigeration Fundamentals

Course Descriptions:

These courses provide an introduction to the concept of refrigeration and discusses the most commonly used refrigeration system, the vapor-compression refrigeration system, the relationship between the basic components of a vapor compression system, and also the heat pump cycle.

Courses:	PDHs
Heat Transfer and Basic Refrigeration Cycle	1.5
Thermodynamic States, Properties, and Laws	2
Psychrometrics	1
Multi-Stage and Cascade Refrigeration Cycles	2
Refrigeration System Parameters and Performance	0.5
Refrigerants	2

Every course includes:

- Reading Assignment
- Learning Activities
- Lesson Summary
- Course Exam
- Heat Transfer and the Refrigeration Cycle

Learning objectives:

On completion of this course, you should be able to:

1. Define refrigeration.
2. Identify the five types of refrigeration systems.
3. Name and describe the four basic components of a vapor-compression refrigeration system.
4. Describe the purpose and operation of a heat pump cycle.
5. Identify three applications of refrigeration.

Thermodynamic States, Properties and Laws

Description:

These courses introduce the concepts of thermodynamic states, properties, and laws, efficiency (coefficient of performance) and define the maximum coefficient of performance for a heat pump and refrigeration cycles.

Learning Objectives:

On completion of these courses, you should be able to:

1. Identify common thermodynamic properties.
2. Define thermodynamic state.
3. Describe the first and second laws of thermodynamics.
4. Define efficiency (coefficient of performance).
5. Determine the maximum coefficient of performance of a heat pump and a refrigeration cycle.
6. Use the thermodynamic laws to perform energy calculations on simple refrigeration processes.

Psychrometrics

Description:

Psychrometrics is the field of engineering concerned with the physical and thermodynamic properties of gas-vapour mixtures.

Learning Objectives:

On completion of these courses, you should be able to:

1. Define the terms used on a psychrometric chart.
2. Identify the major components of a psychrometric chart.
3. Use a psychrometric chart to determine moist air properties.
4. Plot cooling and dehumidification processes on a psychrometric chart.

Multi-Stage And Cascade Refrigeration Cycles

Description:

These courses will introduce the concepts of single and multi-stage refrigeration cycles, as well as cascade refrigeration cycles. It will also discuss the various methods for metering the refrigerant flow to the evaporators, including the direct expansion system, the flooded system, and the recirculation system.

Learning Objectives:

On completion of these courses, you should be able to:

1. Explain the ideal single-stage and two-stage refrigeration cycles.
2. Show the ideal single-stage and two-stage refrigeration cycles on a p-h diagram.
3. Explain the operation of a cascade refrigeration cycle.
4. Determine the thermodynamic state of the refrigerant at the inlet and outlet of each component in the ideal single-stage and two-stage refrigeration cycles.
5. Explain the operation of direct expansion, flooded, and recirculation refrigeration systems.

Refrigeration System Parameters and Performance

Description:

In these courses, several refrigeration system performance parameters are defined. These parameters are useful for characterizing how well a particular system may be operating. Compressor performance is also discussed.

Learning Objectives:

On completion of these courses, you should be able to:

0. Determine the overall system performance characteristics of a refrigeration system..
1. Determine compressor performance.
2. Explain deviations between actual and ideal refrigeration systems, using the p-h diagram.

Refrigerants

Description:

These courses provide an introduction to refrigerants, including selection, performance, safety, reliability, environmental impact, and economic viability.

Learning Objectives:

On completion of these courses, you should be able to:

1. Explain why the list of available refrigerants has changed.
2. Characterize refrigerants according to ANSI/ASHRAE Standard 34.
3. Determine the maximum refrigerant concentration in air, based on the refrigerant's toxicity level.
4. Identify two standards that are important in the selection of refrigerants and in the design of refrigeration systems.

Refrigeration Equipment

Description:

An introduction to the configurations and operation of air cooling and liquid cooling evaporators, positive displacement and aerodynamic compressors and the different heat transfer processes.

- Separate Inch-Pound (I-P) and metric (SI) versions are available.
- PDHs: 11.5

Designed for:

- Recent engineering graduates working in HVAC&R
- Engineers entering HVAC&R from another area
- Technicians

After completing this course, you will understand:

- The configuration and operation of air cooling and liquid cooling evaporators.
- The operating principles of positive displacement and aerodynamic compressors.
- The basic convection heat transfer processes involved in the condensation of the refrigerant vapor discharged from the compressor.
- The two modes of fluid flow in a pipe: laminar and turbulent. The Darcy-Weisbach equation and the Moody chart.
- The information concerning various expansion devices.
- The functions of vessels that may be included in a refrigeration system that store liquid refrigerant and to separate liquid from vapor.

Course description:

- On-demand, interactive course of 6 courses
- Online course reader with easy-to-print PDFs
- Online self-assessment

Courses:

		PDHs
1)	Evaporators	1.5
2)	Compressors	2.5
3)	Condensers	1.5
4)	Pipes, Valves and Pumps	2.0
5)	Expansion Devices	2.0
6)	Pressure Vessels	2.0

Every course includes:

- Reading assignment
- Learning activities
- Lesson summary
- Course exam

Learning Objectives:

The 6 online courses help you to understand:

- The heat transfer methods, overall heat transfer coefficient, purpose of fins on an evaporator, and the basic configurations of air cooling evaporators and liquid cooling evaporators.
- The basic operation of a compressor, the two efficiencies for reciprocating compressors, basic operation of different types of compressors.
- The condensation process, the operation of the air-cooled and water-cooled condenser, the air side processes on the psychometric chart and the need for purging the non-condensable gases from the refrigeration system.
- The laminar and turbulent flow, the Darcy-Weisbach equation and the Moody chart, operation of positive-displacement pumps and centrifugal pumps, and give a suitable application for each, and the term net positive-displacement pumps.
- The operation of capillary tubes, short tube restrictors, pressure control valves, thermostatic expansion valves, low- and high-side level control valves, and the application of a turbo expander in a Brayton refrigeration cycle.
- The four classifications and function of vessels in a refrigeration system, and the refrigerant charge in a system.

Advanced Energy Design for Small Office Buildings

The Advanced Energy Design for Small Office Buildings course explains the design concepts, strategies, and recommendations for constructing energy efficient small office buildings.

PDH Value: PDH: 7.5

Designed for:

Contractors, designers, and owners who are building and maintaining office buildings that are up to 20,000 square feet

After completing this course, you will understand:

- Design strategies and recommendations made by the Advanced Energy Design Guide for Small Office Buildings.
- Techniques and “how-to” tips for the implementation of the Advanced Energy Design Guide for Small Office Buildings principles.

Course description:

- On-demand, interactive course of 7 courses
- Online course reader with easy-to-print PDF files
- Online self-assessment

Courses:

Also sold individually as short courses		PDHs
1)	Design Strategies and Recommendations	1.5
2)	Quality Assurance	1
3)	Building Envelope	2
4)	Lighting	1
5)	HVAC Equipment and Systems	1
6)	Service Water Heating	0.5
7)	Bonus Savings	0.5

Every course includes:

Reading assignment

- Learning activities

- Lesson summary
- Course exam

Learning Objectives:

The 7 online courses help you to understand:
Purpose and scope of AEDG

- Different stages and advantages of the AEDG design process
- Activities that constitute each AEDG design stage
- Responsibilities of various personnel in each AEDG design stage
- Energy goals and strategies for designing small office buildings
- Eight climate zones defined by the U.S. Department of Energy (DOE) and the design recommendations for each of the zones
- Importance of quality assurance in meeting the performance goals established for small office buildings
- Good design practices for the quality assurance process
- Suggested commissioning scope for small office buildings
- Good design practices, available options, and cautions for:
  - Opaque and vertical glazing envelope
  - Daylighting and daylighting controls
  - Interior and exterior lighting
  - HVAC equipment and systems
  - Service water heating systems
  - Plug load equipment

Advanced Energy Design for Small Retail Buildings

The Advanced Energy Design for Small Retail Buildings course is a thorough study of the design concepts, strategies, and recommendations suited to the energy requirements of small retail buildings.

PDH Value: PDH: 8

Designed for:

Contractors and designers who create retail buildings up to 20,000 square feet

After completing this course, you will understand:

- Design strategies and recommendations made by the *Advanced Energy Design Guide for Small Retail Buildings*.
- Techniques and how-to tips for the implementation of the *Advanced Energy Design Guide for Small Retail Buildings* principles.

Course description:

- On-demand, interactive course of 7 courses"
- Online course reader with easy-to-print PDF files
- Online self-assessment

Courses: Also sold individually as short courses.

		PDHs
1)	Design Strategies and Recommendations	1
2)	Quality Assurance	1
3)	Building Envelope	1.5
4)	Lighting	1.5
5)	HVAC Equipment and Systems	1
6)	Service Water Heating and Bonus Savings	1
7)	Examples and Case Studies	1

Every course includes:

Reading assignment

- Learning activities
- Lesson summary
- Course exam

Learning Objectives:

The 7 online courses help you to understand:

- Different stages and benefits of the AEDG design process
- Activities that constitute each AEDG design stage
- Responsibilities of various personnel in each AEDG design stage
- Energy goals and strategies for designing small retail buildings
- Eight climate zones defined by the U.S. Department of Energy (DOE) and the design recommendations for each of the zones
- Importance of quality assurance in meeting the performance goals established for small retail buildings
- Good design practices for the quality assurance process
- Suggested commissioning scope for small retail buildings
- Good design practices, available options, and cautions for:
  - Opaque and vertical glazing envelope
  - Daylighting
  - Interior and exterior lighting
  - HVAC equipment and systems
  - Service water heating systems
  - Plug Load equipment

Air-Conditioning System Design Manual

The Air-Conditioning System Design Manual is a thorough study of the different types of local and central air-conditioning systems. It provides information on the design considerations, applications, functioning, advantages, and disadvantages of these systems.

PDH Value: PDH: 24.5

Designed for:

Engineers and contractors who are involved in the designing and installation of air-conditioning systems

Learning Objectives:

- Describe the phases of the commissioning process and the responsibilities of the HVAC engineer during each phase
- Define the conditions that govern equipment location and space requirements
- Compare the noise-levels of different terminal equipment and list their potential solutions
- Differentiate between central and local systems
- Define comfort and health criteria that influence design
- Describe humidity control, indoor air quality control, and air contaminant reduction
- Describe the heating and cooling load calculation procedures
- Explain the importance of manual and computerized load calculation procedures
- Describe the following equipment and components used in air-conditioning systems, along with their types, benefits, and design considerations:
  - Source equipment
  - Heat transfer equipment
  - Distribution components
- Describe the design considerations, functioning, advantages, and disadvantages of all-air HVAC systems
- Interpret the effects of heating and cooling loads using a psychrometric chart
- State five commonly used versions of the fan laws and describe their applications
- Describe single-zone and variable-air-volume all-air systems
- Describe the psychometric considerations that influence the VAV system design
- State the design considerations that make it possible for VAV systems to enable energy savings
- Describe the energy and economical viability of reheat systems and their design considerations
- Describe dual-duct systems and their variations
- Analyze the design considerations made for dual-path systems
- Describe multizone systems and explain their design considerations, advantages, and disadvantages
- Describe simple rooftop systems and list their advantages and disadvantages
- Define air-and-water systems and list their design considerations, advantages, and disadvantages
- Describe alternative air-and-water system arrangements
- Describe the key attributes on the basis of which all-water systems are selected as a project solution
- Describe the three types of all-water systems and discuss their benefits and design considerations
- Describe the all-water terminals
- Explain the shortcomings of ventilation in all-water systems
- Compare all-water fan-coil systems with other HVAC systems
- Explain the design sequence for all-water systems
- Describe the workings of desiccant dehumidifiers
- Describe parallel and series desiccant systems and discuss their benefits and applications

- Describe the various energy-efficient subsystems
- Identify the components of a control system and the symbols used for them in schematic diagrams
- Describe the three types of control hardware used in HVAC&R systems and list their advantages and disadvantages
- Describe the VAV, single-zone, and dual-duct control systems

Course description:

- On-demand, interactive course of 16 courses
- Online course reader with easy-to-print PDF files
- Online self-assessment

Courses:

	PDHs
The Design Process	2.5
HVAC System Selection Issues	1
Occupant Comfort and Health	1.5
Load Calculations	1.5
AC System Components—Source Equipment	2
AC System Components—Heat Transfer Equipment	1
AC System Components—Pumps, Valves, Piping & Ductwork	1.5
Introduction to All-Air Systems	0.5.
Single-Zone and Variable-Air-Volume All-Air Systems	1
All-Air Reheat Systems	0.5
Dual-Duct and Multizone All-Air Systems	1.5
Simple Rooftop All-Air Systems	0.5
Air-and-Water Systems	2
All-Water Systems	3
Special HVAC Systems	3
HVAC&R Controls	1.5

Every course includes:

- Reading assignment
- Learning activities
- Lesson summary
- Course exam

In addition, a few of the courses contain case studies for the better understanding of the content.