



COLORADO SPRINGS SCHOOL DISTRICT 11
Achievement, Learning & Leadership

NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022

HIGH SCHOOL LEVEL

Course Name:	Wilderness First Responder
Course Code:	IT.OUTWFR
State Course Code:	18501
Subject/Department:	Industrial Technology/PWR
Course Length:	One (1) Semester
Grade:	9-12
Prerequisite:	Wilderness First Aid
Credits per Semester:	(1) Postsecondary Workforce Readiness (PWR), Practical Arts (PA), or Elective (EL)
Course Description:	Focuses on the prevention, assessment, and treatment of injuries and illnesses common to backcountry travel and how to manage a rescue. The course introduces patient assessment, standards of care, team dynamics, and critical thinking used during wilderness emergencies. This course is intended for outdoor enthusiasts and professionals who travel, recreate, and work in remote environments.



Instructions for content facilitator:

Please fill out the course information referencing the request submission. Add any comments needed and sign. Then route to secondary EDSL for signature. Once signature have been obtained, submit to the Director of Curriculum and Instruction; Achievement, Learning and Leadership for final review.

Cut and paste information from the request form here:

Content Facilitator Name/Role: Duane Roberson, CTE Director	Content Area: Career & Technical Education	Date: 2/9/2022
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If this request originated by a staff member other than the content facilitator listed, please list their name and role or leave blank.

Course Title (if this is a deletion request, provide the current details):

Wilderness First Responder

Course Length: 1 Semester

If this is a change, what is the New Course Length:

Course Code: IT.OUTWFR

State Course Code/SCED: 18501

Subject/Department: Postsecondary Workforce Readiness/Career Readiness

Grade: 9-12

Prerequisite:

Credits per Semester: **One (1) – PWR (Required)**

If this is a change, what are the new Credits per Semester? **NO**

Course Description:

Focuses on the prevention, assessment, and treatment of injuries and illnesses common to backcountry travel as well as how to manage a rescue. The course introduces patient assessment, standards of care, team dynamics, and critical thinking used during wilderness emergencies. This course is intended for outdoor enthusiasts and professionals who travel, recreate, and work in remote environments

If this is a change please share the Reason for the Change/Deletion:

Remember to include a copy of a course outline (**not a link**) with this approval form when submitting for signature. No requests will be processed without this documentation.

Is this a new course?	YES: ☒ XXXX NO: ☐
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STANDARD COMPETENCIES:

REQUIRED COURSE LEARNING OUTCOMES:

1. Identify and initiate treatment of traumatic, medical, or environment-related problems in patients following industry standards of care for a wilderness context.
2. Identify life-threatening conditions in a patient and initiate appropriate treatments and evacuation procedures.
3. Determine whether a patient requires evacuation to advanced care, applying industry-standard decision-making.
4. Identify potential environmental emergencies in the backcountry and initiate appropriate preventative measures.
5. Apply management techniques for basic non-life-threatening injuries and illnesses on a patient in a backcountry setting.
6. Perform patient care for extended periods in a remote environment when evacuation is delayed, not indicated, or not possible.
7. Identify essential information when calling for a rescue.
8. Demonstrate evacuation practices of a patient in backcountry environments.
9. Practice proper documentation for a backcountry emergency.

REQUIRED TOPICAL OUTLINE:

- I. Introduction to Wilderness Medicine
 - A. Wilderness medicine law and liability
 - B. Emergency medical system
- II. Anatomy and physiology
 - A. Cardiopulmonary system
 - B. Skeletal system
- III. Basic life support
 - A. Cardiopulmonary resuscitation
 - B. Airway obstruction
 - C. Automated external defibrillator
- IV. Patient assessment
 - A. Scene-size-up
 - B. Primary assessment
 - C. Secondary assessment
 - D. Reassessment
- V. Traumatic emergencies
 - A. Bleeding
 - B. Shock
 - C. Wilderness wound management
 - D. Burns
 - E. Wilderness-related athletic injuries
 - F. Dislocations
 - G. Fractures
 - H. Spine Injuries
 - I. Traumatic brain injuries

- J. Chest injuries
- K. Abdominal injuries
- VI. Medical emergencies
 - A. Diabetes
 - B. Seizures
 - C. Cardiac emergencies
 - D. Strokes
 - E. Respiratory emergencies
 - F. Allergies and anaphylaxis
 - G. Abdominal pain
 - H. Gastrointestinal illnesses
 - I. Motion sickness
 - J. Genitourinary urogenital issues
 - K. Behavioral emergencies
 - L. Colds, coughs, and flu-like illnesses
 - M. Eyes and ear problems
- VII. Environmental emergencies
 - A. Dehydration
 - B. Hyponatremia
 - C. Heat illnesses
- VIII. Evacuation
 - A. Stabilizing the patient
 - B. Evacuation practice
 - C. Documentation
- IX. Rescue protocols
 - A. Calling
 - B. Preparing
 - C. Debriefing

Wilderness First Responder Pacing Guide

<u>Week 1</u>	<u>Targeted Standards</u>
<ul style="list-style-type: none"> • Introduction to class/expectations ~ CKH activities – Social Contract • Pre-test - written • Introduction to the Wilderness First Responder 	<ul style="list-style-type: none"> • Monitor Client Status. Understand the processes of assessing, monitoring, and reporting patients/clients' health status to treatment team based on protocol and implement within scope of practice in order to document, evaluate, and adapt treatment plans. ☐ Manage an incident scene as a first responder using emergency response skills ☐ Execute safety procedures and protocols associated with local, state, and federal regulations ☐ Execute protocols for handling emergency situations that range from minor medical emergencies to area wide incidents
<u>Week 2-5</u> <ul style="list-style-type: none"> • Anatomy & Physiology <ul style="list-style-type: none"> ○ Chest including heart and respiratory ○ Musculoskeletal system ○ Gastrointestinal system ○ Urinary & Reproductive systems ○ Brain 	
<u>Week 5</u> <ul style="list-style-type: none"> • Basic Life Support <ul style="list-style-type: none"> ○ CPR review ❖ Skills and scenario practice 	

<p><u>Week 6</u></p> <ul style="list-style-type: none"> • Patient Assessment. <ul style="list-style-type: none"> ◦ Scene-size-up – BSI/PPI ◦ Primary and Secondary Assessment ◦ Reassessment – Documentation ❖ Skills and scenario practice 	
<p><u>Week 6-9</u></p> <ul style="list-style-type: none"> • Traumatic Emergencies – ex. <ul style="list-style-type: none"> ◦ Wilderness wound management ◦ Breathing difficulties ◦ Dislocations ◦ Burns ◦ Shock etc. ❖ Skills and Scenario Practice 	<ul style="list-style-type: none"> □ Evaluate Client Status. Evaluate patient/client needs, strengths, and problems in order to determine if treatment goals are being reached. □ Choose appropriate evaluation tools to assess patient/client response to treatment plan. □ Analyze information gathered. □ Revise or create modifications to treatment plan based on patient/client response.
<p><u>Week 9-10</u></p> <ul style="list-style-type: none"> • Medical Emergencies – ex. <ul style="list-style-type: none"> ◦ Diabetes ◦ Seizures ◦ Abdominal pain and gastrointestinal illness ◦ Genitourinary urogenital issues ◦ Behavioral emergencies etc. ❖ Skills and scenario practice 	<p><u>PWR Alignment 2.01 and 2.08</u></p> <ul style="list-style-type: none"> • Apply logical reasoning and analytical skills • Collect and analyze quantitative data and research • Read, write, listen and speak effectively
<p><u>Week 11-14</u></p> <ul style="list-style-type: none"> • Other Wilderness Considerations <ul style="list-style-type: none"> ◦ Environmental ◦ Bites & Stings ◦ Protection from the elements ❖ Skills and scenario practice 	
<p><u>Week 15-16</u></p> <ul style="list-style-type: none"> • Evacuation <ul style="list-style-type: none"> ◦ Evacuation & Rescue protocols ◦ Stabilizing the patient ◦ Protection from the elements ❖ Skills and scenario practice 	
<p><u>Week 16-17</u></p> <ul style="list-style-type: none"> ❖ Review of skills and scenario practice – exam prep 	
<p><u>Week 18</u></p> <ul style="list-style-type: none"> • Written exam • Practical exam 	
	<p>✚ Restorative Circles – These will be done as classroom building, review, and industry connections</p>



COLORADO SPRINGS SCHOOL DISTRICT 11
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NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022

HIGH SCHOOL LEVEL

Course Name:	Telecom Technologies 1
Course Code:	IT.TELECOM1
State Course Code:	10006
Subject/Department:	Industrial Technology/CTE
Course Length:	One (1) Semester
Grade:	9-12
Prerequisite:	None
Credits per Semester:	(1) Postsecondary Workforce Readiness (PWR), Practical Arts (PA), or Elective (EL)
Course Description:	Telecommunications Technology Systems; Introduction to Technology: Connect with business and Smart Home technologies by receiving hands-on training in communications systems. Throughout this course, a wide variety of topics will be covered, including the basics of home networking, home automation, security, and entertainment systems. In addition, students will learn a range of useful skills, from setting up a home office to fine-tuning a home theater sound system. This course provides an understanding of both current and future Smart Home and Business systems, so the information will be applicable for years to come. Familiarity with this material is also a must for careers in architecture, interior design, construction, installation, real estate, and all other fields that frequently come into contact with these rapidly evolving technologies.

**REQUIRED COURSE LEARNING OUTCOMES:
STANDARD COMPETENCIES:**

Course Description Objectives and Timing

Telecommunications: Technology Systems (40 hours)

Introduction to Telecommunications

Course Description: Connect with today's Business and Smart Home technologies by receiving hands-on training in business and intelligent communications systems. Topics that are covered include the basics of home networking, automation, and security and entertainment systems. Learn skills that range from setting up a home office to fine-tuning a home theater sound simply by moving speakers. This course provides understanding of both today's and tomorrow's Smart Home and Business Systems and is also a must for careers in architecture, interior design, construction, installation, real estate, and all other fields that frequently come into contact with these rapidly evolving technologies.

Certification: Telecommunications Technology

Module 1 Introduction

Goal: In this module students will be familiarized with the concepts of sound and sound generation as it pertains to audio systems. Students will explore the concepts of sound using real-life examples and actual audio equipment.

Objectives:

- 1.1 Identify that this course consists of seven modules
- 1.2 Identify the Interactive Telecommunications Board as the representation of various system types found in the field of connectivity.
- 1.3 Define types of cables used in this course
- 1.4 Describe the testers used in this course
- 1.5 Identify the TAB as the telecommunications activity board and it is used for experiments
- 1.6 Identify the adapters and how they are used
- 1.7 Describe the tools used in this course
- 1.8 Watch a tool video and take notes on tool operation
- 1.9 Identify the contents of the Student Consumable Kit
 - 1.9.1 RJ 11 Connectors
 - 1.9.2 Two Pair Wire
 - 1.9.3 Coaxial Connectors
 - 1.9.4 Coaxial Cable
 - 1.9.5 Safety Glasses
 - 1.9.6 Student Manual
 - 1.9.7 Student CD
- 1.10 Define safety
- 1.11 Identify aspects of personal protection to include:
 - 1.11.1 Clothing
 - 1.11.2 Head and Scalp

- 1.11.3 Ears and Eyes
- 1.11.4 Hands and Feet
- 1.11.5 Respiratory
- 1.12 Identify fire protection including a fire extinguisher
- 1.13 Describe tool safety for both hand tools and power tools
- 1.14 Describe the safe use of ladders and fall protection
- 1.15 Define the following terms in regards to safety
 - 1.15.1 Hot Work
 - 1.15.2 Proximity Work
 - 1.15.3 Stability Control
 - 1.15.4 Access

Module 2 The Evolution of Telecommunications Systems

Goal: This module provides students with a historical overview of the communication process and the history and development of today's telecommunication devices. This module focuses on the telecommunications process, transmission media and an overview of system functions and operation. Students construct a telecommunications system and use it to send encoded messages with both sound and light.

Objectives:

- 2.1 Identify historical figures that contributed to modern day system development
- 2.2 Define Communications
- 2.3 Define the four parts of communication
- 2.4 Define Telecommunications
- 2.5 Demonstrate that messages are encoded and decoded
- 2.6 Define what a transducer is and give an example of a transducer in use
- 2.7 Identify key points in the development and the attributes of communications systems to include:
 - 2.7.1 Heliograph
 - 2.7.2 Telegraph
 - 2.7.3 Photo Phone
 - 2.7.4 Telephone
 - 2.7.5 Radio
 - 2.7.6 Television
 - 2.7.7 Satellite
- 2.8 Describe modulation and how it is used to send messages
- 2.9 Define Modulate and Demodulate
- 2.10 Correctly follow directions and construct a communications device and use it to send visual and electronic messages
- 2.11 Explain how to construct a communications device
- 2.12 Define Medium as the way a message is transferred
- 2.13 Define Media as the message in modern day communications systems
- 2.14 Identify interlaced and progressive scanning as it pertains to television
- 2.15 Describe how a cellular telephone changes cells while you travel
- 2.16 Given a chart of telecommunications systems identify the connectivity system used

Module 3 Mediums of Telecommunications

Goal: An overview of the devices, components and the importance of the Physical Layer as designed by the OSI model used in IT. This module provides an overview of broadband communication systems, limitations, and the media involved. Students construct a connectivity system and use it to send two-way messages.

Objectives:

- 3.1 Identify the role of the OSI model
- 3.2 Identify the Physical Layer as the connectivity layer
- 3.3 Define the difference between megabytes MBs and megabits Mbs
- 3.4 Use Scientific Notation to determine relative data rates
- 3.5 Define the requirements for both telephone and broadband systems
- 3.6 Identify the need for broadband systems in regards to bps
- 3.7 Identify attributes of the following broadband communication systems
 - 3.7.1 DSL
 - 3.7.2 BPL
 - 3.7.3 Cable
 - 3.7.4 FIOS
- 3.8 Identify the attributes of wireless systems to include:
 - 3.8.1 Wi-Fi 802 Series
 - 3.8.2 Blue Tooth
- 3.9 Identify the following wired media systems:
 - 3.9.1 Copper 2 pair
 - 3.9.2 Copper 4 pair
 - 3.9.3 Coaxial
 - 3.9.4 Fiber Optic
- 3.10 Correctly construct a 2-pair telephone cable
- 3.11 Identify that continuity is not the same as configuration
- 3.12 Define the operation of connectivity testers
- 3.13 Demonstrate how to test a 2-pair cable
- 3.14 Configure the TAB to send a message over a 2-pair system
- 3.15 Using testers, demonstrate how to test a 4-pair system
- 3.16 Perform a continuity test on a fiber optic system
- 3.17 Test coaxial system
- 3.18 Identify connectivity components
- 3.19 Define IDC as insulation displacement connectivity
- 3.20 Watch a demonstration about connectivity device termination and identify the steps involved

Module 4 System Layouts, Testing and Troubleshooting

Goal: This module involves diagramming signal flows and incorporating those flows in the development of block diagrams that indicate system connectivity. Students also learn the basics of troubleshooting. Higher order thinking skills are developed while using testers and devices. Students also complete technology learning activities to demonstrate concept mastery.

Objectives:

- 4.1 Identify all of the devices on the ITB to and their role in telecommunications
 - 4.1.1 System types
 - 4.1.2 Components

- 4.1.3 Connective devices
- 4.1.4 Faceplates
- 4.2 Define the source components on the Interactive Telecommunications Board
- 4.3 Determine the connectivity and signal flow on the following systems located on the ITB
 - 4.3.1 The Green System
 - 4.3.2 The Red System
 - 4.3.3 The Blue System
 - 4.3.4 The Black System
 - 4.3.5 The Orange System
- 4.4 Correctly block the diagram of the systems located on the ITB
- 4.5 Demonstrate how to check a cabling system using:
 - 4.5.1 The TAB
 - 4.5.2 The DAVE-3 Transmitter
 - 4.5.3 The DAVE-3 Receiver
 - 4.5.4 The DAVE-3 Tone and Trace feature
- 4.6 Test 4-pair connectivity systems
- 4.7 Test coaxial connectivity systems
- 4.8 Test fiber optic cables using the student personal optical tester
- 4.9 Identify common troubleshooting methods
- 4.10 Using the TAB complete a troubleshooting activity
- 4.11 Explain the troubleshooting process as a result of the TAB activity
- 4.12 Given a troubleshooting problem on the ITB, correctly find a fix or work around it

Module 5 Business Telecommunication Systems

Goal: This module covers basic business communications technology system to include computer networks, telephone systems, fax connectivity and paging systems. Students complete troubleshooting scenarios and determine placement of office technology systems.

Objectives:

- 5.1 Define the technology systems that are found in the business environment
- 5.2 Define the function of networked computers
- 5.3 Identify common computer internal and external devices
- 5.4 Define NIC as a Network Interface Card
- 5.5 Given a NIC identify the ACT light and LNK lights and their functions
- 5.6 Define the difference between LAN and WAN
- 5.7 Identify typical computer topologies and layouts
- 5.8 Define simple networking terms
- 5.9 Identify the role of standards in computer networking
- 5.10 Determine the difference between advisory and mandatory terms
- 5.11 Define the role of the Modem
- 5.12 Define the role of the Router
- 5.13 Given a router, determine network status by deciphering power, status and connection lights
- 5.14 Correct a simulated office connectivity fault
- 5.15 Identify the function and types of office telephone systems
- 5.16 Identify the difference between the Key, PBX and VoIP systems
- 5.17 Understand telephone options to include:
 - 5.17.1 Hold

- 5.17.2 Transfer
- 5.17.3 Conference
- 5.17.4 Speaker
- 5.17.5 Intercom
- 5.17.6 Do Not Disturb
- 5.18 Identify the importance of a station test
- 5.19 Listen to a ring pattern and determine if a call is an outside call, intercom or a transferred call
- 5.20 Define the role of office paging systems
- 5.21 Define types of paging systems to include: Talk Back, Paging Zones, and Visual
- 5.22 Define the role of the voice mail system
- 5.23 Identify the three types of voice mail to include: Mail, Automated Attendant or call answering
- 5.24 Identify seven things that business's like about voice mail and seven things people don't like
- 5.25 Identify the seven responsibilities of an office administrator
- 5.26 Define the role of the office Fax machine
- 5.27 Identify the main parts of a Fax machine
- 5.28 Define how a Fax is connected
- 5.29 Given an office blue print, determine the placement of business telecommunications systems

Module 6 The Smart Home

Goal: This module covers residential technologies. Students learn the types of systems and the connectivity systems used in Smart Homes. Students explore the four types of smart home technologies and learn the application and technologies of each. Students construct a coaxial system as part of the home entertainment exercise.

Objectives:

- 6.1 Define the term Smart Home
- 6.2 Define the four aspects of Smart Home technologies
 - 6.2.1 Entertainment Systems
 - 6.2.2 Security Systems
 - 6.2.3 Networking Systems
 - 6.2.4 Control Systems
- 6.3 Identify the three parts of all Smart Home Systems
- 6.4 Define the role of Gateways and Distribution systems
- 6.5 Describe a design of self developed Smart Home technology
- 6.6 Define Entertainment Systems and the role of the following:
 - 6.6.1 Home Audio
 - 6.6.2 Home Theater
 - 6.6.3 Video/Satellite/cable
- 6.7 Construct and test a coaxial connectivity system
- 6.8 Define Security Systems and the role of the following:
 - 6.8.1 Cameras
 - 6.8.2 Security/Alarm/Surveillance Systems
 - 6.8.3 One master control with remotes
 - 6.8.4 Remote security and observation
- 6.9 Define Networking Systems and the role of the following:
 - 6.9.1 Internet connectivity
 - 6.9.2 Telephone connectivity

- 6.9.3 Types of networks to include
- 6.9.4 Wired
- 6.9.5 Wireless
- 6.9.6 Hybrid
- 6.10 Define that Control Systems consist of the following
 - 6.10.1 Automation systems
 - 6.10.2 Control systems
 - 6.10.3 Monitoring
- 6.11 Identify Infrared control devices
- 6.12 Perform testing with infrared sensors and sources
- 6.13 Design a Smart Home using a least three technologies

Module 7 Career Pathways

Goal: This module covers the future of work and the future Workforce. It describes what employers want and the importance of proper training. Students investigate career selection strategies including that of the entrepreneur.

Objectives:

- 7.1 Identify trends in the future Workforce and the nature of work
- 7.2 Define the traits that employer's desire
- 7.3 Identify the importance of attitude, ability and appearance
- 7.4 Identify the career clusters
- 7.5 Define the steps in selecting a career path
- 7.6 Select a career cluster; explain two jobs in that cluster and the skills required
- 7.7 Identify current trends in telecommunications
- 7.8 Define typical career progression in relation to skills and experience
- 7.9 Identify that telecommunications spans several career clusters
- 7.10 Identify how telecommunications is used by:
 - 7.10.1 Customer Service
 - 7.10.2 Interior Design
 - 7.10.3 Builders and Architects
 - 7.10.4 Realtors
 - 7.10.5 Others
- 7.11 Given a scenario as a customer service representative use the EARR model to explain a problem to a customer
- 7.12 State questions that designers and architects would ask a customer in regards to telecommunications systems
- 7.13 Given a scenario as an interior design consultant recommend to a customer how a telecommunications system should be placed
- 7.14 Define entrepreneur
- 7.15 Identify some of the questions asked to determine if an individual wants to start their own business
- 7.16 Identify what is contained in a business plan
- 7.17 Identify the importance of certified programs to employers and industry
- 7.18 Identify the importance of certified programs to an individual
- 7.19 Identify what a low voltage license is and define some of the requirements

Three Part Final Exam



NEW COURSE OR COURSE CHANGE REQUEST

Instructions for content facilitator:

Please fill out the course information referencing the request submission. Add any comments needed and sign. Then route to secondary EDSL for signature. Once signature have been obtained, submit to the Director of Curriculum and Instruction; Achievement, Learning and Leadership for final review.

Cut and paste information from the request form here:

Content Facilitator Name/Role: Duane Roberson, CTE Director	Content Area: Career & Technical Education	Date: 2/9/2022
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If this request originated by a staff member other than the content facilitator listed, please list their name and role or leave blank.

Course Title (if this is a deletion request, provide the current details):

Telecom Technology 1
Telecom Technology 2
Telecom Technology 3
Telecom Technology 4
Telecom Technology 5
Telecom Technology 6

Course Length: 1 Semester

If this is a change, what is the New Course Length:

Course Code:

State Course Code/SCED: 02139

Subject/Department: Postsecondary Workforce Readiness/Career Readiness

Grade: 9-12

Prerequisite:

Credits per Semester: One (1) – PWR (Required)

(example: One (1) Humanities or Elective)

If this is a change, what are the new Credits per Semester?

(example: One (1) Humanities, Practical Arts, Postsecondary Workforce Readiness (2021+), or Elective Credit

Course Description:

If this is a change, what is the new Course Description? This is not a change in course

TELECOM TECHNOLOGY 1: Telecommunications Technology Systems; Introduction to Technology: Connect with business and Smart Home technologies by receiving hands-on training in communications systems. Throughout this course, a wide variety of topics will be covered, including the basics of home networking, home automation, security, and entertainment systems. Students will learn a range of useful skills from setting up a home office to fine-tuning a home theater sound system. This course provides an understanding of both current and future Smart Home and Business systems, so the information will be applicable for years to come. Familiarity with this

NEW COURSE OR COURSE CHANGE REQUEST

If this is a change please share the Reason for the Change/Deletion:

Remember to include a copy of a course outline (**not a link**) with this approval form when submitting for signature. No requests will be processed without this documentation. *See page 2 of 2*

Is this a new course?	YES: XXXX NO: ☐
Is this a course change?	YES: ☐ If yes, Please specify the change: NO: XXXX
Is this a course deletion?	YES: ☐ NO: XXXX
Will this course require submission to NCAA Clearinghouse? (all Math, ELA, Science, SS, WL courses are required)	YES: ☐ NO: XXXX

Please share any additional context if needed

SIGNATURES

The Content Facilitator :	
Name: Duane Roberson	Date: 2.11.2022
Signature: 	
RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?

The Executive of School Leadership :	
Name: <i>Dan Hoff</i>	Date: <i>02/24/22</i>
Signature: 	
RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?



COLORADO SPRINGS SCHOOL DISTRICT 11
Achievement, Learning & Leadership

NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022

HIGH SCHOOL LEVEL

Course Name:	Telecom Technologies 2
Course Code:	IT.TELECOM2
State Course Code:	10006
Subject/Department:	Industrial Technology/CTE
Course Length:	One (1) Semester
Grade:	9-12
Prerequisite:	None
Credits per Semester:	(1) Postsecondary Workforce Readiness (PWR), Practical Arts (PA), or Elective (EL)
Course Description:	<p>Network Cabling Specialist Copper-Based Systems. This program provides the skills and knowledge desired universally by industry professionals for entry-level employment in the telecommunications and connectivity fields through extensive hands-on training. Graduates will be trained in all phases of installation and maintenance of copper networking and coaxial cabling systems. This includes aspects of data, voice, and video for both commercial and residential applications. Students work with authentic cabling and connectivity devices, tools, and testers as they label, pull, terminate, test, and troubleshoot copper-based systems found in Businesses and Smart Homes. Also covered in this course are best industry practices, Power over Ethernet (PoE) technologies, commercial and residential cabling standards, and cable routing/placement techniques</p>

**REQUIRED COURSE LEARNING OUTCOMES:
STANDARD COMPETENCIES:**

**Course Description Objectives and Timing
Introduction to Network Cabling Copper-Based Systems Version 4.0**

1. Introduction and Safety

3 Hours

This module provides for a program overview to include: credentialing, program hardware, tools, testers and consumables. Hands-on activities include verification of testers and Advanced Cable Trainer (ACT) operation. Students are familiarized with PPE and practice safe lab procedures.

2. Cabling Science

4 Hours

This module deals with the science of connectivity using copper twisted pair cable. Topics covered include: wire, AWG, conductors, insulators, bandwidth, categories and aspects of twisted pair cabling. Participants investigate unshielded twisted pair and shielded twisted pair cabling. Communications system in terms of noise and attenuation as noise canceling strategies are covered as is basic electricity concepts and PoE systems.

3. Four Pair Cabling Systems

5 Hours

This module covers the fundamentals of four pair cabling systems in terms of Continuity and various Configurations. The Registered Jack (RJ) standard is covered. Students construct patch cables using Category 6A U/UTP and S/FTP cable. The ACT is used to replicate cabling faults and students complete extensive troubleshooting activities in determination of cabling faults.

4. Commercial Topologies and Connectivity

4 Hours

This module covers commercial topologies from the Demarcation Point in the Entrance Facility to the Work Area Outlets. Students are familiarized with different types of topologies, locations, cross connects and cabling infrastructures. Participants discover various types of IDC connectivity devices. Students terminate, test and verify operation of 66 Blocks, 110 Blocks and RJ45 jack systems.

5. Coaxial Cabling Systems

3 Hours

This module covers relevant aspects of Coaxial cabling to include construction characteristics, nominal Impedance and applications. Participants will be versed in several termination techniques and familiarized with current connected technologies. Coaxial cable construction and testing methods are key components of this module.

6. Residential Systems

4 Hours

This module deals with residential systems for both single dwellings and Multi-Dwelling Units. Participants discover the five "Smart Home" connected areas. Connectivity from the ISP to the outlet for various broadband systems are covered. Students work with PoE systems, construct cabling systems and verify operation of LED lighting systems. Students design Smart Home systems and calculate the cost of a job based on parts, cable and labor.

7. Lightning Protection, Grounding and Bonding

3 Hours

This module covers Grounding and Bonding structures in both commercial and residential situations. It stresses the importance of grounding and bonding systems in the protection of personal and equipment. Lightning mitigation and surge suppression devices are discussed as well as NEC terms and Grounding and Bonding practices are discussed.

8. Installation Practices and Job Site Safety

6 Hours

This module covers the phases of installation, job site safety and codes and standards applications. Participants prepare, plan and conduct cabling installation of both data and Coaxial cabling systems using the Copper Systems Trainer and Remote Units. Installations are tested and verified.

9. Network Operation and Connectivity

3 Hours

This module covers networking and connectivity principles as they apply to a cabling technician. The protocols, hardware, connectivity and operation of smart home and businesses networks are covered. Students construct a Loopback plug and verify operation of a Network Interface Card.

10. Testing and Troubleshooting

2 Hours

In this module, participants learn the three levels of testing and the various tests that are run as part of the cabling systems certification process. Testing and issues caused by Noise, Attenuation and the cabling are addressed.

Students will be able to read and understand Qualification and cabling Certification results



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NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022

HIGH SCHOOL LEVEL

Course Name:	Telecom Technologies 3
Course Code:	IT.TELECOM3
State Course Code:	10006
Subject/Department:	Industrial Technology/CTE
Course Length:	One (1) Semester
Grade:	9-12
Prerequisite:	None
Credits per Semester:	(1) Postsecondary Workforce Readiness (PWR), Practical Arts (PA), or Elective (EL)
Course Description:	<p>Grounding & Bonding Technician: This program is an advanced course in our new Applied Systems Integration Series, designed to provide additional skill sets that allow for a complete understanding of grounding and bonding systems and applications. With the convergence of electrical and telecommunications, this program provides detailed information on the National Electric Code (NEC) as well as the responsibilities of the technician in dealing with these systems. Students ground and connect network interface devices, work with armored cabling systems, utilize multiple bonding connectors, and connect both primary and secondary electrical surge devices.</p>

**REQUIRED COURSE LEARNING OUTCOMES:
STANDARD COMPETENCIES:**

Course Description Objectives and Timing

**TELECOM TECHNOLOGY 3: Applied Systems Integration:
Grounding & Bonding version 1.0 Course Objectives**

Module 1 Introduction

This module covers the course overview including course layout and design, equipment, tool usage and safety.

Objectives:

- Define that Grounding/Bonding and Copper Connectivity Systems program provides essential skills allowing a technician to connect services to a residence or business
- Identify the program consists of six modules and successful completers can receive a certificate of completion
- Define the importance of staying current with technologies and applications
- Describe program attributes and supports including the New Terms, other programs and the National Electric Code
- Define that the end of course test is based on module reviews, module questions and new terms
- Identify that the Grounding and Bonding Interconnection Trainer, GIT represents a residential or business connectivity system
- Describe the functional parts of the GIT including the NID, Intersystem Bond, Secondary Protection and the Buss Bar
- Define the Demarcation point as the point of entry of services
- Define that the student workstation and the GIT represent real connectivity and grounding devices
- Identify the parts of the student workstation as the NID, Intersystem Bonding Terminal, Buss Bar and Secondary Surge Protection.
- Define the tools used in this course to include: Wrenches, Crimpers, Electricians Scissors, Electricians Knives, Cable Cutters, Screwdrivers, Cat 5 Stripper, Punch down tool and Multi-meter
- Use safety glasses when working with tools or conductors
- Identify the consumable supplies to include: Cat 5e UTP, Conductors, Lugs, Crimp Rings, Shield Connectors and Electrical Tape
- Identify the American Wire Gauge as a wire measurement system.
- Describe the cables and conductors used in this program and identify them by their AWG designation
- Describe that as the length of a cable is increased so is its resistance
- Identify that a thick cable has less resistance than a thinner cable
- Identify that the National Electric Code, NEC, is written by the National Fire and Protection Agency NFPA and that compliance is mandatory

- Identify that the NEC is revised every 3 years
- Identify safety considerations when working with tools
- State when to report and injury either on the job or in the classroom
- Define that 811 is a national system of utility identification and service protection that is supported by industry
- Identify that electric shocks can be fatal and state how to prevent from being shocked
- State what to do if someone is shocked

Module 2 The National Electric Code

This module covers the purpose and application of the National Electric Code. Layout and usage of the NEC is the focus of this module.

Objectives:

- Identify the National Electric Code provides guidance on a wide range of electrical systems applications.
- Define that the NEC is written and provided by NFPA and it is revised every 3 years
- Describe what is and what is not covered in the NEC
- State how the NEC is arranged in the delivery of content
- Explain the NEC layout in terms of it's components including introduction, chapters, articles, sections and parts
- Identify that the NEC as part of the NFPA begins with Article 90 and that page numbers begin with 70 -1
- Define the nine chapters of the NEC
- Identify a chapter as pertaining to overall rules, special items, stand alone and communications systems
- Identify the contents of the ten Informational Annexes, A through J.
- Describe the layout of the NEC articles in regards to applicable chapters
- Define chapters, articles, sections and parts
- Given a table, compare applications of two telecommunications installation rules
- Review NEC Introduction Article 90 and describe the nine parts
- Define the terms: mandatory rules, permissive rules and explanatory material
- Review NEC definitions Article 100 and define related common terms in line with this program
- Define special NEC items including: Exceptions, Fine Print Notes, Subscripts and Marginal Notes
- Describe how to find information in the NEC per section number
- Define that article 800 is the area that addresses telecommunications
- Identify that articles 800, 810 and 820 relate to communications cable, satellite TV and CATV

Module 3 Grounding and Bonding Systems

This module covers grounding and bonding as they pertain to telecommunications

systems. Students will identify grounding systems, components and applications. They will connectorized grounding and bonding components using supplies and tools.

Objectives:

- Describe the reasoning for a grounding system for both personal and equipment protection
- Identify the role of the technician in the verification of properly grounded systems
- Identify how electricity flows and what makes up a current path
- Define how grounding works to provide a path to ground
- Define sneak current and describe how it can be prevented
- Define that neutral is grounded but ground is not neutral
- Define that telecommunications systems need to be grounded for safety and reliability
- Identify grounding as a means of conduction and protection from lightning, electrical surges and spikes.
- Identify and state the application of the electrical ground conductor, intersystem bond, grounding rod and the NID grounding conductor
- Identify the grounding and bonding attributes located on the GIT
- Identify that indoors the electric panel is grounded and telecommunications device grounds connect to that location.
- Define what a structured media center is and how it is grounded in a Smart Home
- Describe the purpose of all parts of grounding and bonding system to include: Grounding Connectors, Bonding Components, Grounding Conductors, Grounding Rods and Buss Bars
- State the difference between grounding and bonding
- Define equipotential plane as a connected infrastructure at the same potential
- Describe the three types of grounding conductors as solid, stranded and braided
- Identify that the size of a conductor is determined by the current carrying capability of a grounded system
- Describe three bonding methods as mechanical, compression and exothermal welding
- Identify the operation of the three bonding methods
- Connect grounding systems on the student workstation simulating an interconnected ground
- Describe the four parts of a commercial grounding system as TMGB or TGB, TBB, GE and BCT
- Determine the size of the Telecommunications Bonding Backbone as determined by its length
- Correctly crimp a cable to a lug and connect the lug to a buss bar
- Identify common grounding and bonding terms in the NEC
- Define grounding and bonding best practices in terms of EIA/TIA standards
- Describe the responsibilities of a telecommunications technician in terms of a grounded system
- Identify how to safely test a grounded system

Module 4 Lightning and Surge Protection

This module covers lightning protection, types and mitigation strategies for transient

interference and surge protection systems.

Objectives:

- Identify that lightning is a large electrostatic discharge that can affect electrical systems
- Define ideal voltage from a power company as 120 volts at 60 hertz
- Identify voltage problems and define the effects of surges, sags, brownouts and transients
- Identify that harmonic distortion is a problem of frequency variation
- Identify that different types of loads can cause current to lead or lag voltage
- Define noise on electrical lines as EMI, RFI or ESD
- Define that ESD is the equalization of a potential
- Identify that static electricity can have a potential of over 3,000 volts
- State the purpose of an ESD wrist band
- Describe how lightning is created
- Identify that lightning can damage equipment and the effects can be destructive, disruptive and dissipative
- Define the five areas of facility protection as outdoor grounding, direct strike protection, indoor bonding and surge protection for power and telecommunications lines
- Describe a direct strike protection system
- Identify the three types of surge protection and state where the protection is located
- Define primary and secondary protection
- Identify the three most popular methods in wiring protection as carbon block, gas discharge and electronic
- Describe the operation of the three protection methods
- Identify what a hybrid SPD is
- Given a chart with SPD application state type, application and response type
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Module 5 Service Provider Connectivity

This module covers outside interfacing connectivity to the entry point of a home or business. It covers grounding requirements at the demarcation point, cabling types and interfacing methods. Students will connect a NID and provide connectivity at the entry point. This module covers the items that a service provider would have to do as part of starting data services to a home or business.

Objectives:

- Define that the Network Interface Device (NID) is the point of termination of provider services
- Identify that there are two parts of the NID and they are the access provider side and the customer side
- Define that the NID has a test port that is used to determine if a fault is on the access provider side or the customer service side
- Identify that the NID in this program only uses two pairs of connectivity
- Define IDC as insulation displacement connectivity

- Describe that in this program the GIT uses 25 pair cable and the student work station uses six pair
- Identify how to open an IDC line module
- Describe the three pathways of connectivity in a NID as service cable delivery, customer cable delivery and grounding
- Describe applications of delivery cables as being rugged, has a means of stress relief and protection
- Identify that a delivery cable depends on the service being provided and they can be coaxial, multi-pair telephone or fiber cable
- Define that aerial cables come from poles, towers or satellite dishes
- Identify that a wedge clamp is used to provide strain relief and secures a cable to a building
- Identify a messenger cable as a part of a cable or lashed to a cable to provide a means to secure a cable
- Identify classes of cable to include general purpose, riser or plenum
- Correctly apply a shield connector on an armored service cable and ground it inside of a NID
- Correctly connect a six pair service cable to an IDC line module
- Correctly connect a UTP cable from an IDC line module to a secondary protection module
- Describe the steps in providing service to a customer through the NID to the secondary protection unit

Module 6 Telecommunications Spaces and Layouts

Residential and commercial topologies, pathways and connectivity are the focus of this module. NEC and Standards and best practices are addressed in terms of connectivity requirements and applications.

Objectives

- Define that a topology is a system of connectivity arrangement
- Identify that topologies can be simple or complex and state an example
- Identify that residences should have a star topology from a structured media center
- Identify the three parts of a commercial topology as locations, cabling and connectivity
- Describe that large commercial systems are expanded to include multiple locations, cabling and connectivity
- Identify locations by their abbreviations as in EF, ER, TR, TE and WAO
- Define the two types of cabling structures as backbone and horizontal
- Identify that there can be two types of backbone cables as first level and second level
- Define that the connectivity deals with distribution points and they can be Main, Intermediate or Horizontal Cross Connects
- Review a complex commercial topology and define all of the locations, cabling and connectivity involved to include MC, IC and HC
- Define the purpose for locations in commercial systems topologies to include Entrance Facilities (EF)
 - Equipment Rooms (ER)

- Telecommunications Room (TR)
 - Telecommunications Enclosure (TE)
 - Work Area Outlet (WAO)
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- Describe backbone and horizontal cabling and connectivity and define applicable types of cross connects involved
 - Identify NEC articles and key points regarding telecommunications spaces
 - Given a list of standards Identify applicable ANSI, NECA, EIA, TIA and ADA topics
 - Describe items and systems within locations
 - Review commercial topology grounding and bonding applications and identify requirements.
 - Define MICE as mechanical shock, ingress, climate and electromagnetic emissions
 - Identify the importance of fire stopping in commercial applications



COLORADO SPRINGS SCHOOL DISTRICT 11
Achievement, Learning & Leadership

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State Course Code:	10006
Subject/Department:	Industrial Technology/CTE
Course Length:	One (1) Semester
Grade:	9-12
Prerequisite:	None
Credits per Semester:	(1) Postsecondary Workforce Readiness (PWR), Practical Arts (PA), or Elective (EL)
Course Description:	<p>Network Cabling Specialist Fiber Optic-Based Systems: This course is a short-term, hands-on program that will provide students with the skills and understanding necessary to secure employment in the area of Fiber Optic Connectivity. As the Fiber Optic build-out continues, technicians are needed at every level, from residential installation to large commercial enterprises that use fiber as a means of high bandwidth telecommunications services. Knowledge gained from this program is highly sought-after by professionals in the industry looking to hire entry-level technicians. Students will learn the theory behind fiber optic transmission systems and practice sharpening skills required for effective fiber cable termination and splicing. Other topics covered in the course are cabling standards and industry best practices, cable routing and placement, optic loss budgeting, and the testing and troubleshooting of fiber optic connectivity systems with optical power meters and OTDRs</p>

**REQUIRED COURSE LEARNING OUTCOMES:
STANDARD COMPETENCIES:**

Course Description Objectives and Timing

TELECOM TECHNOLOGY 4:

Network Cabling Specialist Fiber Optic-Based Systems

Module 1 Introduction to Fiber Optic-Based Systems and Safety

In this module students are familiarized with course structure, certification and career supports. An overview of the hardware contained in the workstations and classroom devices is provided. Certification Supplies are identified. Students perform optical continuity and observation testing. An overview of job site safety, PPE and the establishment of a safe optical connectivity lab is provided.

Objectives:

- ☐ Explain the purpose of the course and how it applies to a Fiber Optic cabling technician
- ☐ Identify that this is a certified course that consists of 10 modules
- ☐ Identify the supports included in this program
- ☐ Define that the certification is based on results of module tests and a three-part final exam
- ☐ Describe BICSI and CEDIA as industry supporters that provide continuing education credits
- ☐ Identify skills acquired in this course apply to a wide variety of Optical Connectivity career options
- ☐ Explain the importance of staying current with technologies and applications
- ☐ Define that the Student Workstation is designed for two students
- ☐ Identify the contents of the Student Workstation and state the purpose of: Termination Trays,
- ☐ Polishing Pucks, Various Strippers, Cleavers, Scissors, Scribe, Crimper, Pulling Jig, Patch Cords, Microscope and Student Personal Optical Tester
- ☐ Perform a continuity test and report results using a SPOT and a Patch Cord
- ☐ Use a microscope and observe an optical cable and list results
- ☐ Identify the contents of the Instructor Workstation and state the purpose of: Three SPOTs, Power Meter and Light Source, Mandrel, Visual Fault Locators, Microscope and Camera and the Infrared Detector Card.
- ☐ Identify the Fiber Systems Trainer, FST, as an interactive optical connectivity trainer
- ☐ Identify and describe classroom equipment to include: Connector Kit, Adhesives, Sharps Container and Piano Wire
- ☐ Define that the contents of the Student Certification Supplies should be accounted for and secured
- ☐ Identify the contents of the Student Certification Supplies to include: Safety Glasses, Applicator Tips, Disposal Disks, Polishing Papers, Patch Cordage, Building Cable, Alcohol Wipes, SC, ST and LC Connectors, Splices and Color Code Card

- ☐ Identify the role of the Occupational Safety and Health Administration, OSHA.
- ☐ Describe three possible job environments an Optical Technician can encounter
- ☐ Identify that Falls are the most common injuries on and off the job
- ☐ Identify that other areas of injury are being Struck By, Caught In Between and Electrocution
- ☐ Describe the importance being aware of your surroundings in accident prevention and give examples
- ☐ Define the role of Personal Protection Equipment, PPE and the areas of protection it provides
- ☐ Identify the purpose of establishing and following Safe Lab procedures in dealing with Optical devices
- ☐ State ten rules of a Safe Optical Connectivity Lab
- ☐ Define that Safety Glasses are to be worn when working optical cable

Module 2 Light and Optics

In this module the basics of light to include speed, wavelength and intensity are investigated. The properties of both visible and non-visible light in terms of wavelength and color are examined.

Participants use power meters and light sources to measure attenuation of cables and the light amplitude of different light sources.

Objectives:

- ☐ Describe that Fiber Optic technology is based on pulses of light traveling through strands of glass
- ☐ Define the “Duality of Light” and how it applies to optical transmission systems
- ☐ Explain the “Double Slit Experiment” and how it demonstrates the duality of light
- ☐ Identify that light is a form of Electromagnetic Energy
- ☐ State the four characteristics of light as: Speed, Wavelength, Movement and Amplitude
- ☐ Identify the speed of light as 300,000 kilometers per second or 186,000 miles per second
- ☐ Define that refraction is the change of light speed and direction in a substance
- ☐ Use the index of refraction formula and determine the speed of light in that material
- ☐ Define the electromagnetic spectrum as waves of energy that are very small and very large
- ☐ Describe electromagnetic wave in terms of frequency, wavelength and amplitude.
- ☐ Define that wavelength and frequency are inversely proportional
- ☐ Identify that the Greek Symbol Lambda indicates wavelength
- ☐ Using the wavelength and frequency conversion formula – convert frequency and wavelength
- ☐ Identify that light wavelengths are very small and are measured in billionths of a meter
- ☐ Define the relative size and relationship of Millimeters, Micrometers and Nanometers
- ☐ Use Scientific Notation in demonstrating the size of visual light wavelengths
- ☐ Define the light wavelengths for the visible and non-visible light
- ☐ Explain that visible light ranges from 400nm to 650nm and given a color state its wavelength
- ☐ Define the acronym ROY-G-BIV and list its meaning

- ☐ Identify that non-visible light with long wavelengths is Infrared Light
- ☐ State that Infrared Light is used in Fiber Optics
- ☐ Identify the warning about looking into a light source
- ☐ Test for Infrared light and verify its presence
- ☐ Describe that light can be reflected or refracted
- ☐ Identify that the angle of incidence is same as the angle of reflection in relation to the normal line
- ☐ Define that Snell's Law demonstrates the amount of refraction between two substances
- ☐ Recognize that a Fresnel Lens is an example of Snell's Law in practice
- ☐ Identify that at the critical angle a light ray stops refracting and totally reflects
- ☐ Define that Optical Transmission is based on Total Internal Reflection
- ☐ Identify that wave intensity is based on the size of the wave
- ☐ Describe that attenuation is the loss of signal strength
- ☐ Identify that wave amplitude is measured in Decibels that is based on a logarithmic scale
- ☐ Given a Decibel to Power chart determine percentage of loss based on Decibels
- ☐ Identify the functions and operation of Power Meter and Light Source
- ☐ Describe the purpose of a Mandrel in testing
- ☐ Given a Power Meter and Light Source determine the attenuation of a cable
- ☐ Perform a cable attenuation measurement using the zero set and subtractive methods
- ☐ Define the difference between testing in dB and dBm
- ☐ Identify the Spectral Sensitivity of the Power Meter
- ☐ Determine power readings on different SPOTs and log results
- ☐ State and log the attenuation comparison results of Spectral Sensitivity testing

Module 3 Light Transmission

This module covers the history and the development of light wave guides used in optical transmission systems. It covers the key aspects of optical fiber cabling in terms of applications, sizes, modes and intrinsic and extrinsic attenuation losses. Participants are familiarized with the optical cable manufacturing process and perform a hands-on inspection and observation activity.

Objectives:

- ☐ Describe that fiber optic telecommunications systems move information quickly and reliably
- ☐ Identify that fiber optic systems deal with the movement of light pulses
- ☐ Describe early uses of light transmission experiments and simple light transmission systems
- ☐ Identify plastic optical fiber, POF, has many applications including autos and audio/video systems
- ☐ State the contents of glass and how it is made
- ☐ Define that glass is an amorphous solid and its state is neither liquid or solid
- ☐ Define that Fiber Optic Communications Technology is based on ultra-pure glass and optoelectronics
- ☐ Identify the development of Light Emitting Diodes and LASERS as key optoelectronic sources

- ☐ Describe the process of Fiber Optical construction and identify the steps involved
- ☐ Identify that glass has a varying attenuation depending on wavelength
- ☐ Given a chart of attenuation of glass at specific wavelengths identify the three primary transmission windows
- ☐ Identify the primary fiber optical wavelengths as 850nm, 1310nm and 1550nm
- ☐ Identify that fiber optic wavelengths are beyond the visible range
- ☐ Describe the parts of an optical cable and define the purpose of core, cladding, and coating
- ☐ Given a timeline of advancements in optic technology indicate three key developments
- ☐ State three advantages and two disadvantages of optical fiber over wired systems
- ☐ Identify the two main types of optical fiber as Single Mode and Multimode
- ☐ Define that single mode has a very small core and only allows a single light mode
- ☐ Identify that single mode cable is used for long distances and multi-mode cable is used for short distances
- ☐ Identify that multi-mode cable can have a core size of 50um or 62.6um.
- ☐ State the outside diameter of fiber optic cables as 125um while core sizes can be 9um, 50um or 62.5um
- ☐ Identify the attributes of and light transmission methods of Step Index and Graded Index fiber
- ☐ Define the acceptance angle of a fiber is the maximum angle that light can enter a fiber
- ☐ Identify that the numeral aperture is indicator of a and optical cables true light collecting ability
- ☐ Define that numeral aperture is a calculation of index of refractions for glasses, air and the fibers acceptance angle
- ☐ Given a Numeral Aperture chart, determine critical angle and acceptance angle
- ☐ Identify that attenuation in an optical cable is caused by absorption and scattering
- ☐ Define that intrinsic loss is internal to the cable
- ☐ Given a color code card, determine the allowable of an optical cable
- ☐ Describe that Rayleigh Scattering is the scattering of light caused by particles in the atmosphere
- ☐ Identify the two of dispersion as modal and chromatic
- ☐ Describe the effects of dispersion in an optical cabling system
- ☐ Define macro-bend as attenuation that happens when an optical cable is bent too tightly
- ☐ Identify that macro-bends are extrinsic while micro-bends can be intrinsic
- ☐ Demonstrate the ability to safely and correctly strip an optical fiber cable and describe and log your observations

Module 4 Fiber Optic Systems

At the completion of this module students will have an understanding of the operation and characteristics of optical sources and detectors used in Fiber Optic systems. Students will be able to match devices to systems. Students will calculate dynamic range, attenuation loss and formulate optical loss budget.

Objectives:

- ☐ Identify that Sources and Detectors are the Active parts of an optical system
- ☐ Describe that Active devices are transducers that change light energy to electrical energy or electrical energy to light energy
- ☐ Identify the key attributes of sources to include coupling, reliability, controlled output and operation
- ☐ Identify the three main types of sources as LED, VCSEL and LASER diode
- ☐ List key attributes of sources to include speed, cost, spectral pattern and cable type application
- ☐ Define coherent and non-coherent as it applies to source outputs and which source emits which
- ☐ Define safety procedures when dealing with Fault Locators
- ☐ Identify the optical fill patterns for the three different kinds of light sources
- ☐ Describe that using different wavelengths it is possible to send and receive data on one fiber cable
- ☐ Describe the Wavelength Division Multiplexing process as multiple wavelengths operating over a single fiber
- ☐ Given a chart on cabling systems, determine core size and source
- ☐ Describe that OM5 is designed for up to four wavelengths per cable and describe the SWDM process
- ☐ Identify photovoltaics as the application of changing light into electrical energy
- ☐ Identify key attributes of optical detectors
- ☐ Define the two main detector types as PIN diodes and Avalanche photo diodes or APD
- ☐ Given a detector state its application
- ☐ Given the strength of a source and the sensitivity of a detector determine the dynamic range
- ☐ Identify that attenuators can be used to solve detector saturation problems
- ☐ Give an attenuation chart determine total system attenuation
- ☐ Calculate the overhead in an optical system given the total attenuation and dynamic range

Module 5 Terminating Optical Cable

In this module, students will terminate both SC and ST Fiber Optic connectors to either 900µm buffered fiber or patch cordage. Safety, tool usage and the steps of termination are covered in the construction and testing of optical patch cords. Students verify continuity and attenuation values of constructed patch cords.

Objectives:

- ☐ Identify that fiber termination involves using ST and SC connectors on patch cordage and building cable
- ☐ Identify the parts of an ST connector and an SC connector to include Boots, Protective Caps, Crimp Rings and Connector Housing
- ☐ Describe that a Building Cable contains six 900µm jacketed fibers and patch cordage contains one 900µm jacketed fiber
- ☐ Define that ST connectors are not crimped and SC connectors are

- ☐ Describe the role of the crimp ring in securing a patch cord to a connector
- ☐ Identify the function and sections of the Fiber Strippers
- ☐ Describe how to use a Jacket Stripper to expose internal fiber strands
- ☐ Identify what gets crimped and what sizes of crimps are completed in the termination of an SC connector
- ☐ Identify safety considerations and the importance of setting up safe lab conditions when terminating fiber cable with connectors
- ☐ State the purpose of the cleaver to score an optical fiber and not to break it
- ☐ Describe the cleaving process
- ☐ Identify the steps of Termination as: Prepare, Test Fit, Glue Assemble, Cleave, Polish, Protect and Inspect
- ☐ Describe the Preparation step and that it includes preparing the Termination Tray, Cables and Connectors
- ☐ Define the two things that are verified during the test fitting of a cable in a connector
- ☐ Identify the action needed if a test fit fails
- ☐ Describe how adhesive and primer are applied to a cable and a connector
- ☐ State how a connector should be polished including types of polishing paper and surface used
- ☐ Correctly and Safely construct an ST to ST patch cord using a 900um jacketed fiber
- ☐ Correctly and Safely construct a SC to SC patch cord using optical patch cordage
- ☐ Describe how to visually inspect a connector and identify common problems in connector termination
- ☐ Perform both a continuity and attenuation test on a completed patch cord and evaluate results

Module 6 Fiber Optic System Components

This module covers connector and connection types including UPC, APC, SFF and MPO systems. Connector color codes, applications and termination methods are covered. Cable enclosures and connectivity with adapters and multicable polarity is covered. Students learn the cleaving process and use that skill in terminating a Pre-Polished LC connector.

Objectives:

- ☐ Identify common optical connectors to include: LC, SC, ST and FC
- ☐ Define simplex as on cable and one-way communication and define duplex as two cable and two-way communication
- ☐ Define SFF as Small Form Factor and describe its application
- ☐ Define MPO as Multifiber Push On and identify that it is capable of connecting 12 or 24 fibers
- ☐ Define Return Loss as the signal loss from reflections caused by mated glass
- ☐ Identify PC as Physical Contact, UPC as Ultra Physical Contact and APC as Angled Physical Contact
- ☐ Describe that APC is an angled contact where PC and UPC are not
- ☐ Given a connection type define approximate Return Loss for each
- ☐ Given a cable color code chart correctly identify the cable type, SM or MM, Application and connector body color

- ☐ Define cable termination methods as Adhesive/Polish, Mechanical or Pre-Polished
- ☐ Describe the three connector termination methods and provide an example of each
- ☐ Identify that an adapter connects like connector types and a hybrid adapter connects different types of connectors
- ☐ Define cable polarity for duplex and MPO cabling systems
- ☐ Describe the purpose of maintaining the correct polarity
- ☐ Identify that the Keyway on an MPO connector shows polarity
- ☐ Define MPO configurations as straight through, reversed or pairs flipped
- ☐ Identify the purpose of enclosures as protection, storage and testing point
- ☐ Describe the purpose of a splice enclosure
- ☐ Identify the purpose of cleaving a fiber and describe the properties of a correct cleave
- ☐ Correctly and safely cleave a fiber at a required length
- ☐ Define the two splicing methods and mechanical and fusion and state the application of each
- ☐ Describe splicing methods and provide standard loss allowance for each
- ☐ Identify the purpose of Fan Out and Breakout connectivity systems
- ☐ Correctly terminate a 900um jacketed fiber with a Pre-Polished LC connector
- ☐ Determine attenuation of a terminated pre-polished connector

Module 7 Commercial Cabling Topologies and Standards

In this module participants learn typical commercial cabling structure layouts and the role of Fiber Optic media and devices. Types of cable, applications, color codes and cable limitations are covered.

Grounding and Bonding responsibilities as it pertains to Fiber Optic cabling and protection is also covered.

Objectives:

- ☐ Identify that a topology is a map of a cabling structure that includes cabling, devices and connections
- ☐ Identify that Fiber Optic Systems can be all of the cabling structure, or parts of it
- ☐ Describe areas where optical fiber is used to augment and support copper cabling structures
- ☐ Given a topology map, identify telecommunications spaces, levels of cabling and distribution points
- ☐ Using an infrared Source, use an IR Detector Card to identify Horizontal Cabling connections
- ☐ Define three considerations when dealing with hybrid Fiber/Copper networks as: Distance, Connectivity and Speed
- ☐ Describe a media converter, its function and applications
- ☐ Define the use of media converters to extend a cabling run beyond the limits of copper connectivity
- ☐ Identify that a lot of network devices do not have optical connections and media converters

- ☐ need to be used
- ☐ Define SFPs as Small Form Factor Pluggable transceivers that allow for a wide variety of
- ☐ optical connectivity
- ☐ Identify that duplex is possible in a single optical fiber by using two different wavelengths
- ☐ Identify that SFPs are hot swappable, able to operate over many miles and can be duplexed
- ☐ Identify the role of codes and standards in the optical cabling environment
- ☐ Distinguish if an NEC term is an advisory or a mandatory term
- ☐ Define that complying with the National Electric Code is mandatory
- ☐ Identify NEC requirements in terms of a spaces and required fire rated cabling
- ☐ Define Plenums and Risers as areas that require specialized cabling
- ☐ Given a cable label identify if a cable is Plenum, Riser or General Purpose
- ☐ Describe the attributes of Conductive, Non-Conductive and Composite Cable
- ☐ Define that Conductive armored cable requires grounding
- ☐ Given a cable label define if a cable is Conductive or Non-Conductive
- ☐ Given a cabling substitution chart, select a suitable replacement cable
- ☐ Define grounding as providing an electrical path to Earth
- ☐ Describe the grounding is a means of protection from electrical surges and lightning
- ☐ Define grounding as a conductive path and bonding as the means of connectivity connection
- ☐ Identify that devices and locations are tied to local Bus Bars and then to the Main Bus Bar to
- ☐ ground
- ☐ Identify standards as guides that should be followed
- ☐ Define standards bodies that determine requirements such as ANSI, EIA and TIA
- ☐ Identify that ANSI/TIA 568.3 D is the standard the applies to cable, connectors, polarity and
- ☐ hardware
- ☐ Given a standard cabling recommendation chart, identify minimum and preferred number of
- ☐ optical fibers
- ☐ Use an optical color code to determine a specific fiber number in bundles of six or twelve
- ☐ Define cables as either IFC or OSP and state application and characteristics of each
- ☐ Define bend radius and state bend limits for both IFC and OSP cabling
- ☐ Describe pull tension limits for building cable, patch cordage and OSP cables

Module 8 Residential Systems

This module covers residential optical systems and distribution from the central office to the Optical Network Terminal located at the premise. Signal distribution, multiplexing and signal splitting are covered as the basis of today's Passive Optical Networks. Home connectivity,

types of ONTs installation considerations are skills needed by installers. Students also splice an optical cable using a mechanical splice.

Objectives:

- ☐ Identify that there are multiple Internet Service Providers, ISPs that provide Fiber connectivity
- ☐ Describe that Fiber can connect directly to a customer or it can be part of the connectivity system to a home
- ☐ Define X in Fiber to X descriptor as Neighborhood, Curb, Home or Premise
- ☐ Define PON as Passive Optical Network that configures connectivity without electronics
- ☐ Describe the difference between a PON and an Active Optical Network, AON
- ☐ Identify the four components in the signal flow path and define their attributes
- ☐ Identify that PONs operate over single fibers that transmit and receive on two different wavelengths
- ☐ Describe the role of the Central Office and that it contains the Optical Line Terminal
Describe wavelength division multiplexing and how it is used to connect a central office to a distribution hub
- ☐ Define the role of an optical splitter and the distribution process to the local pedestal
- ☐ Identify the role of the local pedestal, how its connected and that it can be above or below ground
- ☐ Identify “The Last Mile” and describe that represents close in residential connectivity
- ☐ Given a diagram of an PON identify Central Office, Distribution Hub, Pedestal and ONT
- ☐ Identify that ANSI/EIA-570 is the residential cabling standard
- ☐ Describe the role of the Network Interface Device NID and what it contains
- ☐ Define demarcation point as the point of service into a premise
- ☐ Describe the role of the Distribution Device or Structured Media Center
- ☐ Identify that a ONT, Optical Network Terminal can be Internal or External
- ☐ Given a lighting condition chart determine the status of an ONT
- ☐ Describe that External ONTs are located at the NID and Internal ONTs are inside
- ☐ Identify that the ONT connects to a customers copper-based networking devices
- ☐ Define that an internal ONT must be connected through the NID
- ☐ Identify Grades of Structured Cable and what cabling each grade contains
- ☐ Define that Grade 3 Structured Cable has a mandatory two fiber optic cable
- ☐ MDU as a Multi-Dwelling Unit and give examples
- ☐ Given an MDU topology define Entrance Facility, Main Terminal Space and Customer Connectivity and Distribution Systems
- ☐ Identify that MDUs have two demarcation points, one for the building and one for the customer

- ☐ Splice and optical cable and determine the splice attenuation

Module 9 Optical Systems Installation

This module covers the procedures and steps of cabling installation in both residential and commercial environments. Participants discover the stages of the installation process and key considerations for each step. Placement methods, cable protection and installation strategies are covered. Students configure a building cable for pulling through a conduit.

Objectives:

- ☐ Define the qualities of professional installation including: standards, safely and best practices
- ☐ Identify the stages of installation and describe what happens in each step
- ☐ Describe the importance of installation planning including notes, asking questions and conducting a walk through
- ☐ Identify possible obstacles to installation
- ☐ Describe the importance of the Preparation step and identify key items covered during this step
- ☐ Identify that having items needed on hand saves time and money
- ☐ Define advantages of having a “Go-Bag” as having frequently used items with a technician
- ☐ Identify that a cable must be checked for continuity before installation
- ☐ Describe how to conduct a continuity test on an optical cable
- ☐ Identify a Lab Splice as a quick, reliable and reusable means to connect two optical fibers
- ☐ Define what should be worn and what should not be worn on the job
- ☐ Define the role PPE in self protection
- ☐ State four safety rules and list four things not to do when working with ladders
- ☐ List and describe five safety rules to follow when installing cabling
- ☐ Define standards installation rules for cable types, pathways, bend radius and cable pulling tension
- ☐ Describe Client Operating Spaces and define key considerations when working in that environment
- ☐ Identify that cables must be labeled as to where they connect
- ☐ Define that cable labels are written in a “From – To” format
- ☐ Given a cable label describe its connection points on both ends of the cable
- ☐ Identify that installation can be accomplished in one step or two
- ☐ Describe the two steps of installation as Rough-In and Trim-Out
- ☐ Identify what happens at each installation step
- ☐ Identify residential installation as connectivity to the ONT by underground or aerial cabling
- ☐ Describe the residential installation differences between Internal and External ONTs
- ☐ Define cabling placement methods to include Trays, Supports and Conduits
- ☐ Describe three cable pulling methods using rollers, pulleys and conduits

- ☐ Correctly configure a building cable for pulling using a pulling jig
- ☐ Describe the roll of Fire Stopping materials and state a technician's responsibilities in dealing with Fire Stopping materials

Module 10 Testing and Troubleshooting

This module covers the process of testing optical systems. Participant's test, evaluate and log results of Standards based testing using the optical evaluation systems on the Fiber Systems Trainer. Students are able to read OTDR displays and are versed in optical systems troubleshooting methods.

Overview

- ☐ Define that testing is an important part of a technician's job that verifies a professional installation
- ☐ Identify that troubleshooting is the process of identifying and correcting a problem
- ☐ Describe the Active and Passive components in an optical system and give examples
- ☐ Define that Active components generate, receive and process the light message
- ☐ Define that the Passive components are the light pathways
- ☐ Identify that Testing is a three-step process that includes inspection, testing and documentation
- ☐ Describe what happens at each step of the testing process and give examples
- ☐ Identify the importance of correct installation techniques, connections and hardware security.
- ☐ Describe that the Permanent link is part of the lasting cabling structure while a channel includes patch cords
- ☐ Identify safety rules to follow when testing or troubleshooting a cabling system
- ☐ Correctly use a Power Meter and Light Source to measure insertion loss in a cabling system
- ☐ Identify Tier 1 testing as using a Power Meter and Light Source and Tier 2 testing uses an OTDR
- ☐ Define OTDR as Optical Time Domain Reflectometer and state its function
- ☐ Define cable attenuation, insertion loss and return loss in regards to testing
- ☐ Following the rules of testing, correctly and safely measure insertion loss and log results
- ☐ Identify the three cabling testing methods, where they apply and the expected result
- ☐ Calculate a Light Budget and state attenuation overhead for a specific scenario
- ☐ Map the connectivity, measure and log insertion losses on the systems on the Fiber Systems Trainer
- ☐ State the function of an OTDR in Tier 2 testing
- ☐ Describe the operation of an OTDR
- ☐ Given a OTDR trace or Digital display, indicate distance to and attenuation of specific events along the optical run
- ☐ Define troubleshooting as a four-step process and identify the aspects of each step
- ☐ Describe the split half troubleshooting method
- ☐ Describe typical optical systems troubleshooting strategies and approaches
- ☐ List advanced troubleshooting resources that are available to Optical technicians



COLORADO SPRINGS SCHOOL DISTRICT 11
Achievement, Learning & Leadership

NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022

HIGH SCHOOL LEVEL

Course Name:	Telecom Technologies 5
Course Code:	IT.TELECOM5
State Course Code:	10006
Subject/Department:	Industrial Technology/CTE
Course Length:	One (1) Semester
Grade:	9-12
Prerequisite:	None
Credits per Semester:	(1) Postsecondary Workforce Readiness (PWR), Practical Arts (PA), or Elective (EL)
Course Description:	<p>Introduction to Energy Management Systems is a certified course that is designed to provide students with the basic knowledge of various types of energy and energy-savings strategies. Students work with actual energy management and programmable automation systems. This course provides information on the function, application and science behind today's Smart systems in homes and businesses that monitor, manage, and reduce energy usage. Students will be working with tools, connectivity devices and testers. Wireless Technician: This advanced hands-on interactive course provides additional skill sets that will give students a complete understanding of wireless systems, equipment connectivity, radiofrequency wavelengths, and reception transmission, as well as reception principles, provide an understanding of 4G, 5G, and beyond. Students are placed in the role of a technician and are trained with an emphasis on proper tool and hardware mounting to install, test, and troubleshoot faults within RF wireless systems. A large portion of this course is dedicated to cellular transmission systems including Antennas and Distributed Antenna Systems (DAS), which are commonly installed in large venues such as airports, stadiums, and corporate office buildings that provide necessary cellular/data coverage and capacity.</p>

**REQUIRED COURSE LEARNING OUTCOMES:
STANDARD COMPETENCIES:**

Course Description Objectives and Timing
Telecom Technologies 5: Introduction to Energy Management Systems

Module 1 Introduction and Safety

At the completion of this module, students will be able to identify and be familiar with tools and test devices commonly used in the Energy Management industry. Students will be familiarized with personal and job site safety as well.

Objectives:

- 1.1 Identify the role of an Energy Management Specialist
- 1.2 Define that the Introduction to Energy Management Systems course is a certified forty-hour program that consists of ten modules
- 1.3 Describe the three types of equipment used in this course consist of the Energy Management Trainer, the student workstation and student consumable kits
- 1.4 Define the parts of the Energy Management Trainer
- 1.5 Identify the contents of the student workstation to include the Student Activity Panel, tools, devices and testers
- 1.6 Define the tools used in the Introduction to Energy Management program and describe their usage
- 1.7 Describe the purpose of devices in the student workstation to include the UTP breakout and tape measure
- 1.8 Identify that the UTP breakout is used to test computer cabling systems
- 1.9 Given a tape measure correctly measure a length in English and metric
- 1.10 Operate a multi-meter and determine if it has a working battery
- 1.11 Correctly store a multi-meter when not in use
- 1.12 Identify the parts of a Lux Meter
- 1.13 Correctly use and store a Lux Meter
- 1.14 Use a Lux Meter to measure light intensity
- 1.15 Identify the contents of the student consumable kit and describe their purpose
- 1.16 Identify that safety glasses are to be worn when working with tools or cabling
- 1.17 Correctly terminate a wire with block spade terminals using tools in the student workstation and consumables in the student certification supplies kit
- 1.18 Define safety and identify that safety is everyone's responsibility
- 1.19 Describe that if you are unsure of a procedure, you are required to ask your boss or teacher how to do it safely
- 1.20 Identify that if you are hurt on the job or in the classroom, it is your responsibility to notify your supervisor or teacher
- 1.21 Identify aspects of personal protection for: Head and Scalp, Eyes and Ears, Hands and Feet, Respiratory System, Skin and Back
- 1.22 Identify safety in terms of alarms and fire extinguishers
- 1.23 Describe tool safety for both hand tools and power tools
- 1.24 Describe safe use of ladders and fall prevention measures
- 1.25 Define safety measures for the following: Hot work, Proximity work, Stability control
- 1.26 Specify that access to emergency equipment and electrical panels must be kept clear

Module 2 Energy Management Systems

In this module, Green is defined in terms of energy and energy-saving systems that represent the movement for a healthier planet by reducing everyone's carbon footprint. This module explains how proactive and passive Green Systems save energy. Students will identify types of energy-conserving systems available in lighting, heating, cooling, and automation as well as how they function.

Objectives:

- 2.1 Define Green as a movement to conserve resources and lower individual impact on the ecology
- 2.2 Identify that Green represents energy conservation and carbon footprint reduction
- 2.3 Define Green applications as wise energy choices
- 2.4 Describe ecology as the interrelationship of organisms and their environments
- 2.5 Define carbon footprint as an individual's impact on the ecology
- 2.6 Define key Green terms: regenerate, preserve, conservation
- 2.7 Identify/define the ozone layer of the atmosphere and its function
- 2.8 Define energy and identify energy in different forms – coal, gas, oil, renewable, nuclear
- 2.9 Define why Green applications are important
- 2.10 State some of the efforts to go Green by government and industry
- 2.11 State the properties of energy
- 2.12 Define potential, kinetic, and mechanical energy
- 2.13 Provide one example of each: potential, kinetic, and mechanical energy
- 2.14 State that energy powers everything
- 2.15 Define chain reaction
- 2.16 Identify/explain how each type of renewable energy source (solar, wind, geothermal, hydroelectric) systems function
- 2.17 Identify that electricity is easiest energy to conserve
- 2.18 Identify where electricity is consumed in the home
- 2.19 Explain means to conserve energy at home and in the workplace
- 2.20 Describe the Smart Grid as a connected Energy Management System
- 2.21 Given a chart depicting home energy usage determine system usage
- 2.22 Define kilowatt as the measurement of electricity
- 2.23 Define the parts of an Old-Style electric meter
- 2.24 Read an older electric meter and determine energy usage
- 2.25 Calculate cost of electricity
- 2.26 Define the largest users of electricity in the home as: Heating and Cooling, Lighting, Water Heating and Appliances
- 2.27 Describe measures in each system that can save energy
- 2.28 Identify Proactive Green Systems are the systems that use energy to save energy
- 2.29 Give examples of Proactive Green Systems and state how they save energy
- 2.30 Describe passive Green measures
- 2.31 Define Energy Star and the rationale for manufacture of such appliances
- 2.32 Describe energy-saving measures when using appliances and computers
- 2.33 Describe a Proactive Green Automated System
- 2.34 Identify an In-Home Display (IHD) as a demand-response energy monitoring device
- 2.35 Describe the purpose of an In-Home Display

- 2.36 Identify In-Home Displays as part of a Home Energy Management System (HEMS)
- 2.37 Define Home Energy Management System (HEMS)
- 2.38 Define Phantom Load and describe ways to prevent it
- 2.39 Complete an experiment on the Energy Management Trainer using the Kill-A-Watt device
- 2.40 Describe the steps in SMART goal setting
- 2.41 Define a Green Action Plan
- 2.42 Identify things to consider in developing a Green Action Plan to save energy
- 2.43 Identify that a comprehensive home energy audit can be performed by a professional to examine usage.
- 2.44 Define the steps in a professional home energy audit and describe how it is conducted
- 2.45 Suggest improvements given the results of a professional home energy audit

Module 3 Electricity

This module provides an overview of electric theory as it applies to Automation and Connectivity Systems. Students work with metric measurements, switches, tools, testing devices and the Student Activity Panel to measure and verify electric system operation. Students construct a buzzer circuit and verify its operation. Personal safety and proper tool use are stressed in this module.

Objectives:

- 3.1 Define that electricity is the form of energy that is easiest to move
- 3.2 Identify that electricity can easily be moved or changed
- 3.3 Identify safety considerations when dealing with electricity
- 3.4 Define that electricity is an electromagnetic force
- 3.5 Describe the parts of an atom as protons, neutrons and electrons
- 3.6 Identify the charge of an atomic particle
- 3.7 Define charge and give an example of a static charge
- 3.8 Identify that there are two types of electricity and they are Alternating and Direct Currents
- 3.9 Describe the differences between AC and DC in terms of phase, flow, generation and application
- 3.10 Define hertz and indicate that a 60-Hz signal changes direction 60 times a second
- 3.11 Define converter as a device that changes DC to AC or AC to DC
- 3.12 Identify conductor as a material that permits current flow
- 3.13 Describe insulator and give an example
- 3.14 Define electronic terms to include: voltage, resistance, current, impedance and watts
- 3.15 Given Ohm's Law calculate for voltage, resistance, or current
- 3.16 Define kilowatt as one thousand watts
- 3.17 Use a Kill-A-Watt and determine volts, amps, watts, volt/amps and power factor
- 3.18 Define reactive load and the effect of a reactive load on a Kill-A-Watt measurement
- 3.19 Log results of a Kill-A-Watt measurement for two energy usage situations
- 3.20 Define AWG as American Wire Gauge
- 3.21 Identify that as the AWG number gets larger, the cable diameter gets smaller
- 3.22 Identify that resistance of a cable is related to the diameter and length of the cable
- 3.23 Identify the typical AWG cable size used for automation and electrical cables
- 3.24 Identify that cables can be solid or stranded and define the role of each
- 3.25 Identify that stranded cables are identified by a two-number system, one for gauge and one for the number of strands

- 3.26 Given a color code chart determine a connector color, rated amperage and gauge
- 3.27 Describe a basic circuit in terms of power source, connectivity and load
- 3.28 Identify that electrical shock prevention is to avoid becoming part of an electrical circuit
- 3.29 Correctly and safely use a multi-meter to take electrical measurements for continuity, voltage resistance and current
- 3.30 Identify the voltage is measured across a load and current is measured in line within a circuit
- 3.31 Construct a simple circuit, test it and report results
- 3.32 Identify a transformer uses magnetic flux to move electricity
- 3.33 Define that a transformer can be either step-up or step-down voltage
- 3.34 Describe how a step-down transformer works
- 3.35 Identify that a transformer has a primary and a secondary voltage
- 3.36 Take part in a classroom demonstration and log primary and secondary voltages
- 3.37 Identify purposes and function of three- and four-way switches
- 3.38 Construct a three-way light circuit using SAPs
- 3.39 Define demarcation point as the point of entry in a home or business for external services.
- 3.40 Define that there are two 120-volt systems in a typical home
- 3.41 Indicate that homes receive two 120-volt legs that can be combined for 240 volts
- 3.42 Define how electricity is connected inside a home
- 3.43 Identify and define which cables are hot, neutral, or ground
- 3.44 Given an outlet identify which hole on the outlet relates to each cable
- 3.45 Observe a demonstration with an AC circuit tester and determine good and bad readings

Module 4 Smart Homes on the Smart Grid

This module identifies Smart Grid technology as a network of power distribution, monitoring, and control. Proactive Green systems are identified and explained as wired, wireless, or hybrid networks in homes or businesses. Smart Meters are introduced as the network interface to the Grid, and their function is described.

Objectives:

- 4.1 Define that a Smart Home is a connected home
- 4.2 Identify the Smart Grid as a networked power distribution system
- 4.3 Define Smart Home and state five Smart Home attributes
- 4.4 Indicate that home technology systems provide for our connection, comfort, convenience, and security
- 4.5 Define Proactive Green Systems as the systems that use energy to save energy
- 4.6 Identify that Proactive Green Systems allow consumers to make informed energy choices
- 4.7 Define the five aspects of Proactive Green Systems as Networking and Control, Heating and Cooling, Lighting, Automation and Smart Devices and Energy Monitoring
- 4.8 Identify that the computer is the hub of the home network and it can connect to the Internet and other home devices
- 4.9 Describe wired, wireless, and hybrid home networks
- 4.10 Identify the several types of connectivity systems and networks in a home
- 4.11 Indicate that wired connectivity systems can include data cabling, coaxial, home PNA, power line, or X-10

- 4.12 Identify that network devices can also be connected over Ethernet(PoE)
- 4.13 Identify that wireless connectivity for home networks use the 802.11 Standard
- 4.14 Indicate that Z-Wave and Zigbee systems connect wirelessly
- 4.15 Describe that controls can be on demand, automatic, or sensor-activated
- 4.16 Describe how heating and cooling systems can be proactively controlled
- 4.17 Identify how automated lighting systems can save energy
- 4.18 Identify Smart appliances and provide an example
- 4.19 Identify the role of an energy monitoring system
- 4.20 Identify the parts of a Smart Meter and the functions of the display, scroll, and test port
- 4.21 Read a Smart Meter and determine energy usage
- 4.22 Identify that Smart Meters work on a 24-hour clock
- 4.23 Identify that the Smart Meter is the network interface to the Smart Grid
- 4.24 Define Smart Grid and give reasons for its implementation
- 4.25 Identify the functions of the Smart Grid as a network, and a system for power distribution, monitoring and control
- 4.26 Describe that the Smart Grid is the interconnection of three networks
- 4.27 Define HAN, NAN and WAN as they pertain to the Smart Grid network
- 4.28 Define the goals of the Advanced Metering Regulations
- 4.29 Describe how power distribution grids operate to provide power to users
- 4.30 Define the supervisory control role of the Smart Grid
- 4.31 Identify the two main micro-energy generation systems as solar and wind
- 4.32 Identify how the Smart Grid accepts energy from micro-generation systems
- 4.33 Give examples how Smart Homes save energy connected to the Smart Grid

Module 5 Lighting Systems

This module provides students with knowledge of light creation, lighting systems and their fundamental operation, including design considerations. Students compare various lighting systems in terms of efficiency, color rendition, and intensity. Students work with Lux Meters and determine light luminance. Students are familiarized with current and future prospects in lighting control systems.

- 5.1 Define light as the luminance that provides for the needs of a user
- 5.2 Describe that light can be created in five ways
- 5.3 Identify a source and type of light for the following: Incandescence
- 5.4 Electric Discharge Electroluminescence Photoluminescence Bioluminescence
- 5.5 Identify types of light sources in terms of operation, advantages and disadvantages, types and styles of the following: Incandescent Halogen Fluorescent CFL LED
- 5.6 Identify a diode as a simple semiconductor that permits current to move
- 5.7 Define light as luminance
- 5.8 Describe that luminance is light from a source while illuminance is light reflected from an object
- 5.9 Identify the following light measurement terms: Candela Lumen Foot-candle Lux
- 5.10 Indicate that light from a source dissipates in relation to the Inverse Square Law
- 5.11 Describe the Inverse Square Law and calculate light dissipation
- 5.12 Define typical illumination values in lux for varying lighting situations
- 5.13 Describe how to use a Lux Meter correctly
- 5.14 Use a Lux Meter and measure illumination
- 5.15 Identify how the Inverse Square Law affects meter readings

- 5.16 Identify light has a range of temperature which results in different colors of light
- 5.17 Watch a demonstration and identify light as Cool, Neutral, or Warm
- 5.18 Define that color temperature is measured using the Kelvin scale
- 5.19 Given the Kevin Scale, correlate a luminance with a temperature
- 5.20 Given a lighting situation, identify whether it calls for Warm or Cool light
- 5.21 Identify the Color Rendition Index (CRI)
- 5.22 Relate a CRI reading to a color of light in Kelvins
- 5.23 Define that lighting efficacy is a measurement of watts used and the light produced in lumens
- 5.24 Given an efficacy chart, correlate a lamp type to its projected life and efficacy
- 5.25 Given a lighting facts label indicate cost, projected life, and appearance in Kelvins
- 5.26 Describe lighting design considerations
- 5.27 Describe patterns of light to include Ambient, Task, Decorative, Mood and Scene
- 5.28 Define the three parts of a lighting control system as Light, Control, and Connectivity
- 5.29 Describe two advantages of lighting control systems
- 5.30 Identify that connectivity can be wired or wireless
- 5.31 Identify that control can be local or remote
- 5.32 Define that lighting systems can be controlled by any of the following means: Direct Timer Dimmer Remote Network
- 5.33 Give examples and state operation of the types of lighting systems controls
- 5.34 Define fade up and fade down in dimming systems
- 5.35 Describe how a dimmer operates to save energy
- 5.36 Describe pre-set dimming options
- 5.37 Define X-10 as a power line control system
- 5.38 Describe how an X-10 operates after watching a demonstration
- 5.39 Define Zigbee and Z-Wave as wireless control systems
- 5.40 Describe how a wireless control works after watching a demonstration

Module 6 Heating, Cooling and Ventilation Systems

In this module students learn the basics of heating and cooling system operation and control as well as the science of heat and the ways heat is moved. Students calculate whole-house, office, and zone-specific cooling requirements. Participants in this program, connect, test and operate programmable thermostats and automation systems.

Objectives:

- 6.1 Define HVAC and describe its role in homes and businesses
- 6.2 Define Fahrenheit and Celsius as two temperature scales
- 6.3 Identify the symbol represents degrees of temperature
- 6.4 Convert temperatures from Fahrenheit to Celsius and vice versa
- 6.5 State common temperatures for living spaces and HVAC systems
- 6.6 Define heat as the movement of molecules
- 6.7 Identify that heat can be transferred by more than one method
- 6.8 Identify that heat can be transferred in the following three ways: Conduction Convection Radiation
- 6.9 Provide examples of heat transfer methods
- 6.10 Identify energy always moves from hot to cold
- 6.11 Describe how a radiator works and define its heat transfer method
- 6.12 Define heated molecules are spread out while cold molecules are closer together
- 6.13 Identify that heat rises and cold air sinks

- 6.14 Identify and describe the four parts of a HVAC system as: Source Control
Communication Delivery
- 6.15 Describe the operation of a heating system
- 6.16 Identify how a forced air heating system operates
- 6.17 Define the role of supplies, returns, zones and controls
- 6.18 Describe the operation of a heating system that uses water
- 6.19 Identify the role of radiators and radiator controls
- 6.20 Identify how to correct the heating problem of air in the line
- 6.21 Describe how a geothermal system works
- 6.22 Given a map, identify the locations where geothermal heating may be an option
- 6.23 Define that the AC in HVAC represents Air Conditioning systems
- 6.24 Identify that an air conditioner moves heat from the inside to the outside
- 6.25 Identify pressure and temperatures are relational
- 6.26 Describe that lowering pressure lowers temperature
- 6.27 Describe that a higher pressure is hotter
- 6.28 Describe the parts of an air conditioner and define how they operate
- 6.29 Define an air conditioner as a split system
- 6.30 Describe the operation of a heat pump
- 6.31 Define the terms BTU and EER
- 6.32 Given an EER label, determine energy cost per BTU
- 6.33 Identify that typical cooling requirements are 35 BTU per square foot of space
- 6.34 Given a room size, determine the air conditioning requirements
- 6.35 Define that 12,000 BTU equals one ton of cooling
- 6.36 Given a home's square footage, determine air conditioning requirements in tons
- 6.37 Given the model number of an air conditioner determine its output in tons
- 6.38 Define SEER as seasonal energy efficiency rating
- 6.39 Describe the two types of thermostats
- 6.40 Define the parts of a programmable thermostat
- 6.41 Identify the connectivity and state how the thermostat connects and operates
- 6.42 Indicate the connectivity to operate a thermostat for Heat, Air Conditioning and Fan
- 6.43 View a thermostat connectivity demonstration and identify the steps involved
- 6.44 Define that a thermostat should be placed on an inside wall away from doors and windows
- 6.45 Correctly connect and operate a programmable thermostat on the SAP
- 6.46 Determine the results of SAP connectivity on the EMT
- 6.47 Describe energy savings strategies for HVAC Systems

Module 7 Automation Systems

This module provides an overview of Automation and Connectivity Systems. Automation Systems and their component connectivity and operation are presented. Students connect and configure day/night, occupancy and motion sensors. Students construct and test Power over Ethernet (PoE) connectivity systems.

Objectives:

- 7.1 Define Automation Systems and where these systems are used in homes and businesses
- 7.2 Describe that Automation Systems function as a decision-making process
- 7.3 Identify the engineering symbols and define significance of Start or Stop, Decision and Process labels
- 7.4 Identify a decision tree for a simple process

- 7.5 Define the four parts of an Automation System as Control, Connectivity, Actuators and Detectors
- 7.6 Describe the operation of the parts of an Automation System
- 7.7 Use a decision tree to describe the operation of an Automation System
- 7.8 Describe some of the Automation Systems that are available in a modern office setting
- 7.9 Describe an automation process and draw a decision tree using engineering symbols
- 7.10 Identify the types of Automation Systems to include, heating, lighting and automation, computer-networked systems, telephone and Energy Management Systems
- 7.11 Define how a thermostat is an Automation System and describe its operation
- 7.12 Identify that temperature sensors can be located in several locations and communicate wirelessly to the HVAC system
- 7.13 Complete a programming chart that indicates desired times and temperatures for a home
- 7.14 Given a scenario that describes when a customer is home and the desired temperature for conditions of occupancy and non-occupancy, program a thermostat for four different operations for weekdays and weekend days
- 7.15 Given a connected residential or small business, identify the type of connectivity
- 7.16 Identify the attributes of the following topologies: daisy chain, star and mesh
- 7.17 Identify that a star topology is also called a home run topology
- 7.18 Describe how wireless Z-wave systems use a mesh topology
- 7.19 Define power over Ethernet as PoE
- 7.20 Identify how PoE connectivity systems operate
- 7.21 Given a PoE cabling system check system operation
- 7.22 Use a breakout to check each of the eight PoE wires for voltage
- 7.23 Identify which wires work with AC, Heat or Fan for a PoE thermostat
- 7.24 Define that a twisted pair PoE cable has two wires and they are identified as tip and ring
- 7.25 Complete a chart that identifies pair color, number and whether it is a tip or a ring
- 7.26 Describe the operation of the two parts of the punch down tool
- 7.27 Define IDC as insulation displacement connectivity
- 7.28 Identify that IDC is used in several types of PoE and telecommunications systems
- 7.29 Safely strip a data cable and identify the pairs and colors of each of the eight wires
- 7.30 Identify that jacks and plugs use either a 568A or 568B wiring configuration
- 7.31 Identify the difference between 568A and 568B configurations
- 7.32 Define that jacks can be configured for either 568A or 568B
- 7.33 Terminate a jack with data cabling for the 568B standard
- 7.34 Build a data patch cord using a supply cable and a jack
- 7.35 Use a supply cable and the breakout to verify connectivity and operation between the SAP and the EMT
- 7.36 Describe how actuators work and give an example
- 7.37 Define two types of detectors as day/night and occupancy
- 7.38 Describe the differences and applications of detectors
- 7.39 Describe how a day/night sensor operates lights at night
- 7.40 Use a truth table to determine the polarity of a day/night sensor
- 7.41 Configure a photo cell and an LED to create a day/night sensor that activates the LED during darkness
- 7.42 Configure a photo cell and an LED to create a day/night sensor that activates the LED when light is present

- 7.43 Describe the operation of an occupancy sensor
- 7.44 Define four aspects of occupancy sensors to include: Sensitivity, Field of View, Coverage and Time Delay
- 7.45 Describe what the four aspects mean in terms of occupancy sensor set up and operation
- 7.46 Describe the operation of a passive infrared receiver or PIR
- 7.47 Identify that a pyroelectric transducer detects infrared radiation
- 7.48 Describe a PIR pattern and how it indicates the operation of a PIR
- 7.49 Identify the five parts of a PIR used in this course
- 7.50 Describe the operation of the PIR and how it acts like a detector and an electric switch
- 7.51 Describe how to wire a PIR and describe signal flow
- 7.52 Configure a PIR to detect motion
- 7.53 Configure a PIR to operate an LED when motion is detected
- 7.54 Configure a PIR to operate an LED when occupancy is detected
- 7.55 Connect two or more PIRs together and create a large detection zone
- 7.56 Describe how an ultrasonic occupancy sensor operates
- 7.57 Describe the advantages and disadvantages of PIRs, ultrasonic and dual-technology detectors
- 7.58 Identify special features some manufacturers include in sensors
- 7.59 Given a building floor plan, situate all three types of occupancy sensors in ideal locations

Module 8 Programming

In this module students work with actual X-10 and Z-Wave devices and provide various customer solutions for whole-house systems and a home theater.

Objectives:

- 8.1 Identify that X-10 and Z-Wave as two of the most popular home control technologies
- 8.2 Define that X-10 systems use house and unit codes as unique device identifiers
- 8.3 Describe how X-10 systems communicate information
- 8.4 Identify that devices that share house and unit codes will all work when commanded
- 8.5 Identify the X-10 devices on the EMT and list their associations and unit addresses
- 8.6 Explain the operation of the X-10 dimmer
- 8.7 Identify that an X-10 outlet has one controllable side and one non-controllable side
- 8.8 Identify which outlet on an X-10 System is controllable
- 8.9 State reasons why a transceiver should not be placed into a controllable X-10 outlet
- 8.10 Identify why one side of an X-10 outlet is not controllable
- 8.11 Identify and use the X-10 remote control
- 8.12 Using the X-10 remote control identify that units 1-8 can be selected or units 9-16 can be selected
- 8.13 Identify that if an X-10 remote has 16 possible home associations and 16 home associations, it can control up to 256 devices
- 8.14 Describe the operation of the Eagle Eye and the transceiver module and identify unit settings
- 8.15 Describe the operation of the Socket Rocket
- 8.16 Describe the operation of a dimmer module
- 8.17 Describe the operation of an appliance module
- 8.18 Define the differences between a dimmer module and an appliance module
- 8.19 Program a Socket Rocket
- 8.20 Operate the various X-10 Systems including dimmers, lights, controllable outlets,

- dimmer modules and the Socket Rocket and verify their performance
- 8.21 Identify the X-10 USB computer interface
 - 8.22 Describe additional functions X-10 computer software provides
 - 8.23 Define the terms timers and macros in terms of X-10 communications systems
 - 8.24 Given a customer request, provide a working solution for an X-10 system
 - 8.25 Given a blueprint, identify the recommended placement of X-10 devices and list their associations
 - 8.26 Provide a value-add solution for a customer by adding a dimmer module and a Socket Rocket to their home
 - 8.27 Define Z-Wave as a System that uses an RF-mesh network to send commands
 - 8.28 Identify that for Z-Wave devices to operate properly, Z-Wave devices must be within 30 feet of one another
 - 8.29 Identify and state the function of the Z-Wave Systems to include: switches, dimmers, controllable outlets, remote controls, scene controllers, zone controllers and appliance modules
 - 8.30 Identify the physical differences and operational differences between a scene control and a zone control
 - 8.31 List the Z-Wave devices on the EMT and state their associations
 - 8.32 Identify the operation of scene controller used in a home theater with four zones
 - 8.33 Identify the three types of Z-wave device indicators and describe their meaning
 - 8.34 Describe air gapping as a means to default Z-Wave dimmers and switches
 - 8.35 Default Z-Wave devices and restore them to factory settings including: switches, dimmers, scene controllers, zone controllers, appliance modules.
 - 8.36 Define the terms Devices, Rooms, Areas, Associations and Scenes and how those concepts apply to programming Z-Wave Systems
 - 8.37 Define that the Z-Wave System can interface with a computer using a USB stick and Z-Wave software
 - 8.38 Watch a demonstration and program a scene controller for a home theater taking into account devices, rooms, areas and associations
 - 8.39 Given a blueprint provide a whole-house situation using Z-Wave devices
 - 8.40 Indicate devices and associations
 - 8.41 Program a whole-house Z-Wave System using switches, dimmers, remote, appliance module, scene controller and a zone controller and verify System operation

Module 9 Installation, Testing and Troubleshooting

In this module students learn system installation procedures step-by-step, including planning, rough-in and trim-out in accordance with current NEC, EIA/TIA and CEA codes and standards. After completing this module, students will understand the split-half troubleshooting method and will be able to correct and/or identify faults in connectivity systems.

Objectives:

- 9.1 Identity that system installation can vary in levels of complexity
- 9.2 Describe that when working with new construction a Specialist may have a model home available to verify installation procedures
- 9.3 Define that most of the time a Specialist will be working in a single unit
- 9.4 Define MDU as a multi-dwelling unit and give examples of MDUs
- 9.5 Describe a retrofit installation as one that requires extra planning and adaptability
- 9.6 Identify the five phases of installation as: Planning, Rough-in, Trim-out Set up, Testing

- and Programming
- 9.7 Define the roles and responsibilities of the following in regards to the installation process: Home or business owner Interior designer General contractor Energy Management Specialist
 - 9.8 Define the importance of Codes and Standards in regards to the installation process
 - 9.9 Identify that codes are mandatory and standards are recommendations
 - 9.10 Describe that the National Electric Code may only be made more stringent by local building codes
 - 9.11 Define the agencies represented by EIA, TIA and the CEA standards
 - 9.12 Identify key EIA, TIA, and CEA standards that pertain to systems installation
 - 9.13 Identify implications of mandatory or advisory in terms of codes and standards
 - 9.14 Describe the planning process and identify planning questions and actions
 - 9.15 Define the importance of detailed project documentation
 - 9.16 Identify various items found on a Work Order and Bill of Materials and their significance
 - 9.17 Describe the differences between blueprints and floor plans
 - 9.18 Describe the importance of reviewing the builder's plans
 - 9.19 Identify common energy management symbols used on blueprints and floor plans
 - 9.20 Given a home connectivity system, identify the recommended color per CEA standard
 - 9.21 Given a floor plan, indicate device and cable placement for an Energy Management System
 - 9.22 Complete a bill of materials and work order for an Energy Management System
 - 9.23 Identify safety considerations when installing Energy Management Systems
 - 9.24 Describe the rough-in process as installing the connectivity systems
 - 9.25 Define the importance of using a site survey when doing a rough-in
 - 9.26 Identify tasks that are accomplished during the rough-in
 - 9.27 Describe rough-in considerations in dealing with cabling and cable runs
 - 9.28 Identify the tools used during rough-in and their applications
 - 9.29 Identify trim-out as the installation phase where cabling is connected and devices installed
 - 9.30 Describe tools used in trim-out and their purpose
 - 9.31 Describe the Specialist's role in the setup, testing and programming phase of installation
 - 9.32 Identify that troubleshooting is required when problems are encountered
 - 9.33 Program, test and log the results for an Energy Management System
 - 9.34 Define that the better a System is understood; the easier it is to troubleshoot
 - 9.34 Follow a troubleshooting hierarchy and remedy a problem
 - 9.35 Describe that loop back testing is used to check long wire runs
 - 9.36 Make a jumper and perform a loop back test
 - 9.37 Given a loop back scenario, state expected results as either an open or a short
 - 9.38 Describe the split-half method and how it is used in troubleshooting
 - 9.39 List troubleshooting resources in recommended sequence
 - 9.40 Correctly troubleshoot a simulated problem on the SAP
 - 9.41 Define how to troubleshoot X-10 faults in terms of phase of a 120-volt leg, noise generators or signal siphons
 - 9.42 Describe how to correct the three most common types of faults in an X-10 System

Module 10 Energy Management Applications

This module covers consulting with customers to plan optimal Energy Management Systems. Students work with various design scenarios to develop solutions to ensure ideal energy management installation and efficacy.

Objectives:

- 10.1 Identify the responsibilities and traits of an Energy Management Systems Specialist
- 10.2 Identify who is responsible for problems in relation to interior and exterior problems
- 10.3 Using results of a comprehensive site survey, make recommendations to customers
- 10.4 Identify considerations a homeowner would examine before installing automation or networked system
- 10.5 Describe the importance of simplicity and ease of use as it pertains to the end user
- 10.6 Develop a questionnaire or conduct an interview to determine customer needs and wants
- 10.7 Given an automation price list and a diagram of a home, calculate the cost of materials
- 10.8 Describe how to select the System type for a project
- 10.9 Evaluate results of customer checklist/questionnaire or conduct an interview and take notes
- 10.10 Describe how to conduct an Energy Design Audit and fill out the form
- 10.11 Determine design options and feasibility based on questionnaire, blueprint analysis, customer budget to include the following: Wired Wireless Z-Wave X-10 Smart Home Automation
- 10.12 Suggest alternative(s) for System(s) installation based on blueprint information to meet customer needs
- 10.13 Identify Customer Training needs after the completion of System set up
- 10.14 Develop a strategy to confirm a customer understands programming a thermostat
- 10.15 Identify the importance of reading manufacturers' booklets
- 10.16 Define the importance of customers being able to locate key system information
- 10.17 Provide programming (initial set up and how to change settings), verification of installed System functionality/performance, and basic troubleshooting (in case of electrical failure or other issues) instruction for customer
- 10.18 Define and discuss the importance of the following customer wants: Greater emphasis on performance No surprises
- 10.19 Sized and matched to meet owners' needs Value, Flexibility and Upgradeability
- 10.20 Define future-proofing as it pertains to System selection
- 10.21 Define energy management application design considerations for the following: Lighting Systems, HVAC Systems Networking Systems, Green Applications (passive and proactive)
- 10.22 Provide company or personal business card to ease follow-up and support for customers after installation
- 10.23 Identify professional development resources and industry documents available for Smart Home Professionals – Energy Management Specialists

Telecom Technologies 5: Wireless Systems: Coverage and Capacity

The program is designed for entry level wireless systems installation technicians. As an ASI program it is a follow-on program designed to advance a student's existing skillsets. The focus of the course is on RF principles, operation, installation and troubleshooting of wireless telecommunications systems specifically Distributed Antenna Systems used to enhance cellular coverage in large buildings and entertainment venues. The course is 15 hours in length and consists of 5 Modules.

Module 1 Introduction and Safety

This module covers the course overview, layout and goals. It provides information on certification, CECs and course design. It provides information on the equipment and tools used

in this program. This module also covers safety including PPE and fall protection

Module 2 RF Principles

This module covers RF Principles as they pertain to wireless telecommunications systems. Included in this module are transmission and reception principles, RF energy, Fresnel zones, dB, dBm, dBd, dBi and VSWR

Module 3 Wireless Systems

This module covers Distributed Antenna Systems types and applications. An overview of hardware, functions and applications are covered in the various DAS systems. Passive and Active DAS systems are constructed as part of this module as well as a Grounding and Bonding infrastructure.

Module 4 Installation Best Practices

This module covers the phases of installation and what is involved in each phase. Installation procedures and best practices are covered and students mount Remote Units and Antenna Mounts on sheetrock, plywood and cement surfaces. DAS systems are configured and correct operation is verified.

Module 5 Operation and Troubleshooting

This module includes troubleshooting and testing as a process in the technician's role to provide clear, consistent, and reliable communications. Connectivity is covered including coaxial, STP and fiber optics as well as specialized tests and test equipment used by DAS technicians.

Module 1

This module covers the course overview, layout and goals. It provides information on certification, CECs and course design. It provides information on the equipment and tools used in this program. This module also covers safety including PPE and fall protection.

Objectives:

- Define that the purpose of this course is to provide entry level skill training in Distributed Antenna Systems
- Identify that Distributed Antenna Systems are designed to increase coverage and capacity of cellular coverage
- Describe that DAS technicians may work in a variety of settings including inside and outside
- Identify that this wireless course is a 15-hour advanced systems integration program
- Describe that the program is divided into five modules and identify the content of each
- Identify that this is a certified program that also provides BICSI and CEDIA CECs
- Identify that certification is based on results of a hands-on and written evaluation
- Identify the parts of the Wireless Activity Trainer to include: Antenna with mount, Removable RF Transmitter, Base Station and the Grounding System
- Identify the contents of the student workstation to include: Activity panel, Tools, Testers and Cabling
- Identify the parts of the Activity panel to include: Antenna Mount, Remote, Receiver Unit, RF Coupler, Grounding Infrastructure System
 - Describe the contents of the student workstation: Cordless drill with drill bits,

- Tools, Digital multi-meter and Connectivity Cables
 - Watch a demonstration on how to operate the drill and operate it safely Use a compass and determine direction
 - Use a digital multimeter to perform a continuity test
 - Determine the presence of infrared light using a SPOT and an IR detector card State the indication on a DAVE cabling test set for a correctly working STP and Coaxial
- Cable
 - Identify the parts of the Drilling Workstation Describe the contents of the certification supply kit
- Identify safety items in terms of tool and power tool usage, fall protection, ladder safety and PPE requirements
 - Define OSHA as the government safety compliance entity State type of ladders and how to select a ladder
 - State the importance of fall protection devices while working at heights

Module 2

This module covers RF Principles as they pertain to wireless telecommunications systems. Students work with RF transmitters and receivers to reinforce module concepts.

Objectives:

- Define that waves are the movement of energy
- Identify that RF waves travel at the speed of light and repeats at specific frequencies Define the electromagnetic spectrum as a wide range of wavelengths
- Define wavelength and frequency
- Identify that the relationship between wavelength and frequency is inversely proportional
- Identify that radio waves have a frequency from 3kHz to 300,000Mhz Given a wavelength determine the frequency
- Given a frequency determine the wavelength
- Determine the wavelengths and frequencies used in wireless devices
- Identify that the Federal Communications Commission (FCC) is responsible for radio spectrum management
- Describe how a carrier frequency is Amplitude, Frequency or Digitally modulated Define the parts of the communications process
- Describe how a carrier signal is created, encoded, transmitted and received
- Define the three basic parts of a communications system as the transmitter, receiver and antenna.
- Identify the function of the parts of the Student Activity Panel and Wireless Activity Trainer
- Record received values of RF waves
- Describe the parts of a transmitter to include oscillator, mixer and power amplifier Identify that transmitters generate high energy waves that are measured in decibels Define that the decibel scale is logarithmic and a change of 3dB doubles or halves the power
- Define that dBm is a measurement of relative power based on a one milli-watt reference Given a power to dBm conversion chart determine the wattage for a dBm value
- Identify the function of Antennas as electrical devices that receive electrical

current and convert it to radio waves, used for transmitting and receiving RF information

- Describe how an antenna radiates energy
- Identify that most antennas are $\frac{1}{2}$ or $\frac{1}{4}$ wavelength
- Define the radiation patterns for Omni, Directional and Highly Directional Antennas
Describe the parts of an antenna and determine if it is horizontally or vertically polarized Identify dBi is the measurement of comparison of an antenna to an isotropic antenna Identify that antennas do not create energy but they do have gain or efficiency
- Define the dBm values of acceptable, unacceptable and marginal coverage Describe that waves propagate per the Inverse Square law
- Identify that RF waves can be reflected, refracted, diffracted or absorbed Define multi-path as the RF wave taking more than one path
- Identify a Fresnel zone
- Define the importance of impedance matching transmitters with antennas

Module 3

This module covers Distributed Antenna Systems types and applications. An overview of hardware, functions and applications are covered in the various DAS systems. Passive and Active DAS systems are constructed as part of this module as well as a Grounding and Bonding infrastructure.

Objectives:

- Identify that most cellular traffic occurs from within buildings
- Describe how a cellular call works and how calls are maintained while a caller changes location
- Define DAS as a Distributed Antenna System
- Describe the following wireless systems and their applications: DAS, Wi-Fi, Small Cell, Public Safety DAS, Broadband and Microwave and Outdoor Macro
- Define "Dead Zone" as an area with little or no cellular coverage
- Define the need for increased wireless coverage in buildings and large venues Identify at least three benefits of a DAS
- Identify applications for Distributed Antenna Systems (DAS) Describe the difference between Coverage and Capacity Identify that DAS systems are based on Coverage and Capacity
- Identify that DAS has two major parts and they are the Signal Source and the Distribution System
- Define that a Signal Source is the two-way communications in a DAS Identify that a DAS system can be Passive, Active, Hybrid or Digital
- Define the four types of signal sources as Off-air, BTS, Digital and Small Cell
- Identify the Distribution System as the means that the information is routed in a DAS Describe the hardware and function of DAS components to include:
 - Internal Antenna, External Antenna, Connectivity including Coaxial, Data and Fiber Optics, Remote Units, Main Units, BTS/Distribution, Couplers and Splitters
 - Grounding
- Describe Passive DAS operation, system parts and an advantage and disadvantage

Identify coaxial cabling types, connectors, impedance and attenuation used in DAS Identify that in this course N-Type and SMA type connectors are used

- Given an attenuation chart for coaxial cable plot the attenuation Define the difference between an RF coupler and an RF splitter Define the importance of matching antenna inputs in a Passive DAS
- Complete an activity and determine where a coupler or splitter should be used to balance various antenna inputs
- Configure two antennas with two couplers and conduct an experiment to balance antenna inputs
- Correctly ground the Antenna, Coupler and Remote Unit to an Intersystem Bond or a Grounding Buss Bar
- Verify and measure a Grounding and Bonding System for continuity

Module 4

This module covers the phases of installation and what is involved in each phase. Installation procedures and best practices are covered and students mount Remote Units and Antenna Mounts on sheetrock, plywood and cement surfaces.

Objectives:

- Explain the need to follow directions and not taking short cuts when installing components
- Describe the importance of good workmanship and provide examples
- Define installation as a three-step process that involves planning, preparation and installation
- Describe considerations that happen during the planning phase of installation Identify the importance of doing a walk-through of equipment locations and settings
- Explain the purpose of a site survey in regards to equipment locations and connectivity routing
- Identify the difference between coverage and capacity Describe the parts of an onsite survey checklist
- Define applications that help in locating a cellular tower Identify the purpose of determining RF coverage
- Define that an efficient wireless network provides both coverage and capacity
- Define the preparation step as the step where equipment is identified and job specifics are verified
- Describe considerations during the preparation phase of work Define what is meant by the term "client operating spaces"
- Identify considerations and items that need to be accomplished in working in client operating spaces
- Describe what happens during the installation step
- Identify what is to be installed to include: Antennas, Access Points, Remote Units, Base Stations, Connectivity, RF plumbing and grounding
- Identify connective requirements for coaxial, STP and Optical cabling that protect

- cables and prevent signal distortion or signal loss
- Define the purpose of the National Electric Code and requirements during the installation phase
- Correctly install both an omni directional and directional antenna
- Identify that some components of a DAS may be powered by PoE
- Describe the importance of using a template when installing equipment
- Identify mounting hardware including types of anchors, screws and metal anchors in the installation of Remote Units and Antenna mounts
- Identify regular drill bits, masonry bits and screw driver bits used in the installation process for Remote Units and Antenna mounts
- Correctly install Remote Units and Antenna mounts on sheetrock, plywood and cement board using specific hardware while using correct drill attachments
- Identify the importance of waterproofing outdoor connections
- Correctly use waterproofing tape and electrical tape to waterproof a coaxial connection
- Configure a DAS by connecting, power, RF plumbing and grounding infrastructure and verify correct operation

Module 5

This module includes troubleshooting and testing as a process in the technician's role to provide clear, consistent, and reliable communications. Connectivity is covered including coaxial, STP and fiber optics, as well as specialized tests and test equipment used by DAS technicians.

Objectives:

Define the role of the technician to provide clear, consistent and reliable communications

Identify the importance of professionalism and workmanship when installing a DAS/wireless system

Identify that troubleshooting is a multi-step process that includes verifying, identifying, and correcting a problem

Define that once a problem has been corrected, a log of the symptoms, the problem and corrective action must be documented

Define two causes of poor cellular reception as distance and obstructions

Describe Fresnel zones and how to avoid cellular signal loss

Identify key points when installing RF plumbing connections to include: protection, cleaning, inspection, connection and the use of torque wrenches

Define the make-up of Fiber Optic cable and its role in DAS communications systems

Identify the importance of cleaning Fiber connectors, protecting them and to avoid touching cable end faces

Define attenuation as it pertains to fiber optic connectivity

Identify fiber optic polarity in terms of connectivity and that duplex connectors can be A to A or A to B configured

Correctly connect an ST connector to a Remote Unit and a Base Station

Describe data cabling configurations and where UTP and STP cable is used

Identify the importance of the drain wire in an STP cable and the role it plays in

noise suppression Define PoE as Power over Ethernet

Use a multi-meter and a UTP breakout and determine PoE voltages on a data cable Describe how often a Preventative Maintenance Inspection is performed and what is checked during a PMI

Describe specialized testing to include PIM testing, Attenuation, Signal loss and VSWR

Define the function of specialized test equipment to include:

- Passive Intermodulation

- AnalyzersRf Sweepers

- Spectrum

- AnalyzersTDRs

- ODTRs

- RF Power Meters

- Power Meters and Light Sources



COLORADO SPRINGS SCHOOL DISTRICT 11
Achievement, Learning & Leadership

NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022

HIGH SCHOOL LEVEL

Course Name:	Telecom Technologies 6
Course Code:	IT.TELECOM6
State Course Code:	10006
Subject/Department:	Industrial Technology/CTE
Course Length:	One (1) Semester
Grade:	9-12
Prerequisite:	None
Credits per Semester:	(1) Postsecondary Workforce Readiness (PWR), Practical Arts (PA), or Elective (EL)
Course Description:	<p>Introduction to Home Entertainment – Audio/Video Systems: Become a Smart Home Professional in the area of home entertainment by learning how to install whole-house audio systems and home theaters as effectively as possible. Discover tips like how to place speakers properly for maximum satisfaction or how to create a 360-degree sound stage for Home Theater. Find out the effects of subwoofer placement on sound quality, the difference between using soft and hard spaces, and the advantages and disadvantages of flat panel displays. Work with actual speakers, a 5.1 level system, and C-Tech's interactive trainers to learn not only how to employ the highest degree of listening enjoyment, but also how to master all of the skills necessary to install, test, and troubleshoot audio and video connectivity systems and devices. This course is also appropriate when polishing skills useful for careers in architecture, interior design, construction, installation, real estate, and other fields, as it applies to home entertainment systems of today and tomorrow.</p>

**REQUIRED COURSE LEARNING OUTCOMES:
STANDARD COMPETENCIES:**

Course Description Objectives and Timing

Telecom Technologies 6: Introduction to Home Entertainment – Audio/Video Systems:

Module 1 Introduction to Home Entertainment

In this module students will be familiarized with the concepts of sound and sound generation as it pertains to audio systems. Students explore the concepts of sound using real-life examples and actual audio equipment.

Objectives:

- 1.1 Identify that this Home Entertainment course consists of 11 Modules
- 1.2 Identify that this is a certified course and that scores are based on module tests and a hands-on and written final exam
- 1.3 Define that this is an activity-rich course, with students using a variety of tools and practicing speaker movement techniques
- 1.4 Identify that this course will provide training for an in-demand occupation
- 1.5 Identify the Interactive Audio Trainer as a representation of various system types found in the field of home entertainment
- 1.6 Define the three sections of the Interactive Audio Trainer as:
 - 1.6.1 Outdoor living
 - 1.6.2 Zoned systems
 - 1.6.3 Home theater
- 1.7 Identify inputs and outputs of the Interactive Audio Trainer
- 1.8 Identify other classroom devices to include:
 - 1.8.1 Crossover Junction Box
 - 1.8.2 DAVE Cable Testers
 - 1.8.3 Polarity Tester
 - 1.8.4 Amplifier
 - 1.8.5 Speaker System Sources including Audio and Video
 - 1.8.6 Label Maker
 - 1.8.7 IR Detector Card/Remote
 - 1.8.8 Cabling Set
- 1.9 Identify that the student workstation is designed for two students to work together
- 1.10 Identify the contents of the Student Work Station to include:
 - 1.10.1 Connectivity Termination Box
 - 1.10.2 Cable Cutter/Stripper
 - 1.10.3 Sound Pressure Meter
 - 1.10.4 Volt Ohm Meter
 - 1.10.5 UTP Cable Jacket Stripper
 - 1.10.6 C-Tech Screwdriver
 - 1.10.7 Punch Down Tool

- 1.10.8 RJ45 Crimper
- 1.10.9 Coaxial Cutter/Stripper/Crimper
- 1.10.10 Tape Measure
- 1.10.11 F-Type Coaxial KGC,
- 1.10.12 4-Pair UTP KGC
- 1.11 Identify the contents of the student consumable kit to include:
 - 1.11.1 Student Manual
 - 1.11.2 CET CD-ROM
 - 1.11.3 RJ45 Plugs
 - 1.11.4 F-Type Coaxial cable connectors
 - 1.11.5 Speaker Cable
 - 1.11.6 4-Pair UTP Cable
 - 1.11.7 RG59 Cable,
 - 1.11.8 Home Entertainment Card
 - 1.11.9 Safety Glasses
- 1.12 Indicate how to correctly fill out the C-Tech Job Posting Registration Form

Module 2 Principles of Sound

In this module students will be familiarized with the concepts of sound and sound generation as it pertains to audio systems. Students explore the concepts of sound using real-life examples and actual audio equipment.

Objectives:

- 2.1 Identify that sound is a message that moves in a communications system
- 2.2 Identify the speed of sound in air
- 2.3 Define sound as being made up of waves of electromagnetic energy at particular frequencies
- 2.4 Identify key figures in the development of audio technology
- 2.5 Define frequency as measured in hertz and kilohertz
- 2.6 Identify that the relationship between frequency and wavelength is inversely proportional
- 2.7 Identify the typical lengths of both a low (Bass) frequency wave and a high (Treble) frequency wave
- 2.8 Demonstrate that bass frequencies have a wide dispersion pattern while high frequencies are much more focused
- 2.9 Define the total range of human hearing
- 2.10 Define the parts of the human ear and how the ear does its job
- 2.11 Define that the optimum human hearing range is between 300Hz and 5000Hz
- 2.12 Describe the human ear as more sensitive to midrange frequencies than to treble or bass frequencies
- 2.13 Define Octaves and how they relate to audible sound
- 2.14 Define that what we hear is a complicated wave pattern of mixed audio signals that includes the fundamental frequency component, harmonics and reflections
- 2.15 Define Psychoacoustics and the realm of human hearing to include:
 - 2.15.1 Spectral information
 - 2.15.2 Spatial information
 - 2.15.3 Temporal information.

- 2.15.4 Identify frequency realm and Spatial Realm as two different components of sound that are direct and reflections
- 2.16 Define that we hear differently in the vertical and horizontal planes
- 2.17 Define that the intensity (power) of sound is measured in Bels and decibels (dB)
- 2.18 Identify 3dB as the smallest increment of sound a human ear can detect Identify that volume does not equal loudness
- 2.19 Define that volume is objective while loudness is subjective
- 2.20 Using a sound pressure level meter (SPL) determine relative volumes
- 2.21 Measure sound waves in terms of wave length, amplitude
- 2.22 Identify that frequency responses must be qualified: (as in 60 to 20Hz +or-3dB) to be meaningful
- 2.23 Using graphs determine the components of a frequency response chart

Module 3 Electronics of Sound

In this module, students will explore the electronics of sound systems. Students will be able to identify terms and calculate values for resistance and power. Students will also be familiarized with audio system concepts as they relate to speakers and amplifiers and audio system components.

Objectives:

- 3.1 Identify historical figures in the development of electronics applications
- 3.2 Define common electronic terms and their abbreviations
- 3.3 Describe electrical power as measured in watts
- 3.4 Define volts as the strength of an electrical field
- 3.5 Define watts as volts times amperes
- 3.6 Define resistance as the opposition present in a conductor to the passage of electricity
- 3.7 Define amperes as measuring the rate of flow of electric current
- 3.8 Describe that resistance is measured in ohms
- 3.9 Calculate using Ohm's law
- 3.10 Identify that resistance increases with increased conductor length, and decreases with increased conductor thickness
- 3.11 Define cable gauge requirements for different length cable runs
- 3.12 Comply with safety procedures while testing a speaker cable
- 3.13 Correctly strip a speaker cable and determine its total resistance
- 3.14 Demonstrate how to use a Volt Ohm Meter
- 3.15 Determine resistance of series and parallel networks
- 3.16 Calculate total resistance in combination series and parallel networks
- 3.17 Identify that audio components are rated in watts
- 3.18 Identify that audio components can be rated on either their Peak or RMS values
- 3.19 Define RMS as Root Mean Square
- 3.20 Identify that RMS rating is the true operating power of the component
- 3.21 Given a peak output power, calculate RMS value
- 3.22 Given a manufacturer's specification, determine peak, RMS, THD values
- 3.23 Define Transducer as a device that changes energy from one form to another
- 3.24 Identify speakers as analog devices
- 3.25 Identify that speakers are current-activated devices and they must be matched with an amplifier in order to work properly

- 3.26 Define clipping and its effects on an audio system
- 3.27 Identify that every time there is an impedance mismatch there is loss of power
- 3.28 Define impedance as the total opposition in a system
- 3.29 Identify filters and chokes and their role in speaker crossover networks
- 3.30 Define how a three-way crossover works to funnel selected frequencies to appropriate drivers
- 3.31 Identify digital audio sources
- 3.32 Define media and media storage devices
- 3.33 Define the process of how a digital audio bit stream is developed
- 3.34 Define Analog to Digital Conversion and its importance in home audio systems
- 3.35 Identify impedance in an audio system to include:
 - 3.35.1 Electrical Impedance
 - 3.35.2 Mechanical Impedance
 - 3.35.3 Acoustical Impedance.
- 3.36 Define the nominal and minimum impedance ratings of audio components as important measurements
- 3.37 Identify that impedance factors must be matched among components of a system
- 3.38 Identify two types of volume controls and how they operate
- 3.39 Compare the qualities of Autoformers and Transformer-Free volume controls
- 3.40 Identify that A-Bus is a system that provides audio over UTP cabling
- 3.41 Identify the characteristics of 4-pair UTP cabling

Module 4 Speakers

In this module, students will identify the parts of a speaker, types of speakers and speaker enclosures to including the use of baffles. Students will strip speaker wire and configure their connectivity unit and speakers for operation. Students are familiarized with, and use speaker polarity testers to verify speaker phasing.

Objectives:

- 4.1 Identify historical figures in the development of speaker technology
- 4.2 Identify that speakers are transducers and that they change energy from one form to another
- 4.3 Define speakers as motors with moving parts—the speaker (magnetic) coil causes the cone to vibrate
- 4.4 Identify the main parts of drivers and loudspeakers
- 4.5 Identify how the parts of a speaker work together to produce sound waves
- 4.6 Identify how the selection of cone materials, magnets and voice coils impact the quality of speakers
- 4.7 Identify the different materials used in cone construction and their advantages and disadvantages
- 4.8 Identify line-level and high-level cables and their application
- 4.9 Define a speaker's sensitivity as its ability to produce sound
- 4.10 Define the speaker types and average frequency ranges of
 - 4.10.1 Woofer
 - 4.10.2 Tweeter
- 4.11 Midrange.
- 4.12 Measure the sound pressure levels at various lab locations to determine speaker

dispersion

and

directionality patterns

- 4.13 Define the directional aspects of different types of speakers
- 4.14 Define that crossovers channel audio energy to specific speakers
- 4.15 Define two-way and three-way crossovers and when they are used
- 4.16 Define subwoofers as specialized speakers that handle extremely low-frequency sound and low-frequency effects (LFE) 3Hz – 120 Hz
- 4.17 Identify the attributes of coaxial speakers
- 4.18 Identify the attributes of a dual channel speaker
- 4.19 Identify speaker attributes to include dipole and bipole speakers
- 4.20 Listen to different speakers and explain the quality of sound
- 4.21 Identify the types of connectors used in speaker connectorization
- 4.22 Define that speaker wire should connect speakers to controls, according to the established guidelines
- 4.23 Identify ¼ inch as the acceptable strip length
- 4.24 Strip and connect cables to a speaker
- 4.24 Identify the effects of incorrectly configuring the polarity of speakers
- 4.25 Demonstrate the ability to determine if a speaker system is out of phase.
- 4.26 Test a speaker's polarity
- 4.27 Define the purpose of speaker enclosures and identify two different types
- 4.28 Define resonance and methods to maximize speaker performance
- 4.29 Identify reflection patterns in speaker systems

Module 5 Audio System Devices

In this module, students will be familiarized with all audio system devices and connectivity technologies. Students will connect and operate a Single-zone and Multi-zoned systems. Students will be familiarized with A-Bus technologies. Students will also identify cabling and connector systems used in audio systems and perform construction of a 4-Pair UTP Cable that is used in A-Bus systems.

Objectives:

- 5.1 Identify the 6 components of a sound system as:
 - 5.1.1 Source
 - 5.1.2 Amplifier
 - 5.1.3 Distribution module
 - 5.1.4 Volume Control
 - 5.1.5 Speakers
 - 5.1.6 Listening Room.
- 5.2 Define the three layers of an audio system as:
 - 5.2.1 Front End
 - 5.2.2 Central Consolidation Point
 - 5.2.3 Back End.
- 5.3 Identify equipment placement strategies in relation to system layers
- 5.4 Define each area where the audio signal will be heard as a zone
- 5.5 Define the attributes of single-zone and multi-zoned systems.
- 5.6 Define common types of sources
- 5.7 Define Single-source as using only one type of audio source, and Multi-source as using more than one channel and speakers

- 5.8 Identify that source audio signals must be amplified in order to drive other system components
- 5.9 Describe that an amplifier divides the audio signal into right and left channels
- 5.10 Describe amplifiers as being two-channel or multi-channel
- 5.11 Define amplifier power as measured in Watts Per Channel
- 5.12 Determine amplifier power by dividing Peak power of amplifier by number of zones it's driving
- 5.13 Define acceptable amplifier power to speaker power ratings
- 5.14 Identify key considerations when purchasing an amplifier
- 5.15 Define RCA cables as handling pre-amp signals and identify speaker cable as amplifier power output
- 5.16 Define the color coding of RCA cables as they pertain to audio signals
- 5.17 Define the purpose of a distribution module
- 5.18 Identify how impedance matching modules are used for signal distribution
- 5.19 Identify how passive distribution modules are used for signal distribution
- 5.20 Identify what a media hub is used for and how it is connected in a system
- 5.21 Identify that there should be at least one volume control per zone
- 5.22 Identify that volume controls should be rated the same as the speakers they serve
- 5.23 Describe the characteristics of autoformers and transformer-less volume controls
- 5.24 Define what IR Media send and receive units do and how they are connected in a system
- 5.25 Interpret a manufacturer's Specification Bulletin in regards to audio system compatibility
- 5.26 Define that an A-Bus system provides digital audio over UTP cable
- 5.27 Construct and test a 4-pair UTP cable

Module 6 Multi-Room Audio System Design

In this module, students will be familiarized with speaker placement and strategies to maximize the enjoyment of a system. Students are also familiarized with equipment layout and types of audio systems found in home entertainment systems.

Objectives:

- 6.1 Identify two types of Multi-room systems:
 - 6.1.1 Centralized
 - 6.1.2 Localized.
- 6.2 Define a Centralized system as one using a single amplifier for use in other zones
- 6.3 Identify two types of Centralized Multi-room systems as Multi-source, and Single source
- 6.4 Define a Multi-room Single-source system as one in which a single two-channel amplifier drives speaker pairs and volume controls in different rooms
- 6.5 Define a Multi-room/Multi-source system as one that uses dedicated and separate stereo channels for each room so the user can select different sources in different rooms
- 6.6 Define a Localized system as one that has a low-powered "satellite" amplifier in each room that is part of the volume control
- 6.7 Define Modular systems as being IP Addressable, functioning as a node on a network
- 6.8 Define each zone as having at least one channel
- 6.9 Define each zone as having its own volume control

- 6.10 Identify the bypass system and how it is used with iPod™ type devices
- 6.11 Define two advantage of ceiling speakers as:
 - 6.11.1 They disperse the sound evenly without interference from furniture, etc
 - 6.11.2 The speakers are non-obtrusive from a design point of view
- 6.12 Identify that speakers in a wall are easier to install in a retrofit situation
- 6.13 Define the baffle as an enclosure preventing sound from the back of the speaker from interfering with sound coming from the front
- 6.14 Identify speakers in walls or ceilings rely on the wall space or ceiling space to serve as a baffle
- 6.15 Identify strategies for controlling internal audio reflection
- 6.16 Define how to correctly place speakers in walls or ceilings for maximum performance
- 6.17 Identify that placement of speakers affects the quality of the sound
- 6.18 Describe that speakers in the wall must be at the height of a seated adult
- 6.19 Identify that if speakers are installed higher than the height of a seated adult, they should be inverted so the tweeters are closer to listening height
- 6.20 Differentiate among three different types of sound dispersion
- 6.21 Identify where a woofer should be placed
- 6.22 Identify that two smaller woofers will outperform one big one
- 6.23 Identify that the space in which the audio signal will be heard can affect the quality of the sound
- 6.24 Define Live rooms as having many hard, sound-reflecting surfaces (picture windows, tile, paneling, and hard wood floors)
- 6.25 Define Dead rooms as having many soft, sound-absorbing surfaces (stuffed furniture, thick carpet, wall hangings).
- 6.26 Identify that Live or Dead rooms need different speaker placements
- 6.27 Describe speaker location principles:
 - 6.27.1 Speakers closer to corners or other room surfaces will increase in bass
 - 6.27.2 Speaker coverage should overlap at prime listening locations
 - 6.27.3 For best clarity, speakers should not be obstructed by furnishings
 - 6.27.4 Speakers too distant from listeners can get lost in reverberation in large rooms
 - 6.27.5 Speakers too close to listeners can be a distraction
 - 6.27.6 For low ceilings (7 – 9 ft); ceiling speakers directly over listeners can be a problem
 - 6.27.8 The higher the ceiling, the fewer speakers you need

Module 7 Home Theater

In this module, students will be familiarized with typical home theater systems. Students will develop best placement strategies and learn audio concepts while working with a surround sound system.

Objectives:

- 7.1 Define home theater to be a pleasing entertainment area and considerations to include:
 - 7.1.1 Aesthetics
 - 7.1.2 Audio requirements
 - 7.1.3 Room Acoustics
 - 7.1.4 Video requirements
 - 7.1.5 Lighting.

- 7.2 Define a typical home theater audio installation as 5 channels: right front, center, left front, right rear (surround), left rear (surround), and one subwoofer
- 7.3 Identify that unlike home audio installations, all components are in one room and that no separate volume controls are needed
- 7.4 Define the concept of "Home Theater in a Box" (HTiB)
- 7.5 Explain the basic history and evolution of surround sound
- 7.6 Define a 5.1 system as 5 channels plus a subwoofer
- 7.7 Define a 6.1 system as 6 channels plus a subwoofer
- 7.8 Define a 7.1 system as 7 channels plus a subwoofer
- 7.9 Identify where to place speakers for the following audio systems: 5.1, 6.1, 7.1.
- 7.10 Define that a 45° - 60° angle of the listener's position as ideal for left and right speakers
- 7.11 Explain the need for using shielded speakers near video displays
- 7.12 Define that audio system outputs are color-coded in regards to audio channels
- 7.13 Identify Acoustic Modeling software programs and their purpose
- 7.14 Explain the use of LFE and other inputs/outputs of a powered subwoofer
- 7.15 Identify .2, .3, .4 as having multiple subwoofers
- 7.16 Define the ideal location for the center speaker as midway between the left and right speakers and at same height
- 7.17 Define that ceiling speakers are not recommended for home theater and why
- 7.18 Describe the technique of trading places with the subwoofer to find the optimum location
- 7.19 Identify the major surround sound formats, their manufacturers and their differences
- 7.20 Define THX as an industry-standard certification for component sound quality
- 7.21 Define methods of calibrating a surround sound system
- 7.22 Identify DSP as an acoustic-enhancing feature of AVRs

Module 8 Home Video

In this module, students will learn about different display technologies, related to home video and home theater. Students will also be familiarized with cabling and connection options needed for HDTV, Satellite and Cable TV operation. Students will then learn to strip, terminate and test coaxial cable.

Objectives:

- 8.1 Identify that color displays operate with Red, Green and Blue information
- 8.2 Identify a video display as either, CRT, Flat Panel or Projection
- 8.3 Define qualities that make a good display to include:
Wide viewing angle, Sharp with good contrast, Consistent color, rich in Black and White
- 8.4 Define the types of video systems and the limitations and advantages of each to include:
 - 8.4.1 LCD
 - 8.4.2 Plasma
 - 8.4.3 DLP
 - 8.4.4 Projection.
- 8.5 Identify that control devices use Plasma technology
- 8.6 Identify common television tuner types to include NTSC, PAL, ATSC and DVBS
- 8.7 Identify that television standards specify that video will be MPEG2 and audio will be

Dolby Digital

- 8.8 Identify a scan as either progressive or interlaced
- 8.9 Identify frame rates for common display formats
- 8.10 Identify a display's native resolution and how it can be scaled or up-converted to fit the needs of a viewer
- 8.11 Identify common aspect ratios used in displays
- 8.12 Determine a display in terms of its native resolution
- 8.13 Define the aspect ratios used in common display types
- 8.14 Define video display formats to include:
 - 8.14.1 SDTV
 - 8.14.2 EDTV
 - 8.14.3 HDTV.
- 8.15 Define the aspects of broadcast signals to include:
 - 8.15.1 Over Air
 - 8.15.2 Cable
 - 8.15.3 Satellite
 - 8.15.4 Fiber Optics.
- 8.16 Define types of video signal sources to include:
 - 8.16.1 DVD
 - 8.16.2 HD DVD/Blu-ray
 - 8.16.3 TIVO/DVR.
- 8.17 Identify how devices are connected together in most systems to include:
 - 8.17.1 Satellite or cable interface devices
 - 8.17.2 DVD installations
 - 8.17.3 DVR connection interface
- 8.18 Define the required items to view HDTV
- 8.19 Define cabling considerations for the video portion of a home theater system
- 8.20 Define HDMI as High Definition Multi-media Interface
- 8.21 Define S-Video connection and where it is used
- 8.22 Define Composite Video Connection and when it is used
- 8.23 Read a Component Video Chart and determine cable used and output signals
- 8.24 Correctly construct and test a coaxial cable
- 8.25 Given a diagram of a home theater, correctly draw and label all video inputs and outputs
- 8.26 Given a home blue print, determine component placement and explain strategies used

Module 9 Safety

At the completion of this module, students will be able to identify and explain the safety precautions in terms of personal protection, workplace safety, and other hazards found on the job site.

Objectives:

- 9.1 Define Safety as it applies to a Home Entertainment A/V Technician.
- 9.2 Define what to do if you have an accident.
- 9.3 Define OSHA and its role in workplace safety.
- 9.4 Identify and explain the safety procedures to be followed for personal protection to protect:
 - 9.4.1 Head and Scalp
 - 9.4.2 Eyes and Ears

- 9.4.3 Hands and Feet
- 9.4.4 Respiratory
- 9.4.5 Skin and Back.
- 9.5 Identify and explain the safety procedures to be followed at the work site to include:
 - 9.5.1 Special Instructions
 - 9.5.2 Special Training
 - 9.5.3 Restrictions
 - 9.5.4 Permits
 - 9.5.5 Work Permits
 - 9.5.6 Lock-Out procedures
 - 9.5.7 Access Routes.
- 9.6 Identify and explain the safety procedures to be followed to prevent electrical hazards to include:
 - 9.6.1 Function and use of Ground Fault Circuit Interrupter (G.F.C.I.).
 - 9.6.2 Extension Cords.
 - 9.6.3 Proximity and Hot Work.
- 9.7 Identify and explain the safety procedures to be followed when working with tools to include:
 - 9.7.1 Hand Tools
 - 9.7.2 Power Tools.
- 9.8 Define workspace safety with regard to:
 - 9.8.1 Stability Control
 - 9.8.2 Fall Prevention and Protection
 - 9.8.3 Ladder Safety
 - 9.8.4 Scaffolding
 - 9.8.5 Crawl Spaces
 - 9.8.6 Heat related sickness identification and prevention.
- 9.9 Identify and explain the safety procedures and precautions that should be followed for fire prevention and safety to include:
 - 9.9.1 Location and Access to Fire Alarms.
 - 9.9.2 Emergency Exits.
 - 9.9.3 Classes of Fire Extinguishers.
 - 9.9.4 Types of Fires.

Module 10 Installation Practices

In this module, students will be familiarized with design and installation procedures necessary for a successful job.

Objectives:

- 10.1 Define the advantages and disadvantages of installing an audio system in both a new and existing project
- 10.2 Describe the importance of reviewing the builder's plans for all models of homes in regards to room/zone locations and the location of the home theater
- 10.3 Define that the Centralized Consolidation Point should be in or near the structured cabling panel
- 10.4 Identify that conducting a pre-installation walk-through can save time and trouble later
- 10.5 Identify the need to determine service provider for Cable and Satellite service

- 10.6 Define Location Strategies in terms of:
 - 10.6.1 Indoor speakers
 - 10.6.2 Outdoor speakers
 - 10.6.3 Electrical considerations,
 - 10.6.4 Volume controls
 - 10.6.5 System distribution components
 - 10.6.6 Speaker wiring
 - 10.6.7 UTP wiring
 - 10.6.8 Coaxial cabling and cable outlets
- 10.7 Identify the importance of staying on schedule.
- 10.8 Identify what needs to be included in a Bill of Materials.
- 10.9 Identify key CEA, EIA and TIA standards.
- 10.10 Define common software tools used for installation planning.
- 10.11 Define the recommended wiring scheme for a distribution device with all zones as a Home-Run.
- 10.12 Identify Industry Connectivity Standards/devices on all devices in an audio system.
- 10.13 Identify that documentation of design, wire runs, etc. is essential.
- 10.14 Identify the time after framing and before drywall or AC wiring as the best time for rough-in
- 10.15 Identify mandatory and advisory language of standards and codes.
- 10.16 Identify that audio cabling must be kept away from AC wiring, and cross it at 90°.
- 10.17 Identify that audio cabling must be kept away from heat sources, and electric motors.
- 10.18 Identify that audio controls must be kept away from lighting controls (dimmers, etc).
- 10.19 Define plenum requirements for audio cabling
- 10.20 Identify the correct bend radius for audio cables
- 10.21 Identify the importance of scheduling the Rough-in
- 10.22 Identify the tools and materials that are needed to install an audio system
- 10.23 Define that prior to starting a job, it is necessary to review low-voltage wiring practices
- 10.24 Define considerations used in routing cabling systems
- 10.25 Define wiring installation methodologies
- 10.26 Identify the cause of 60-Cycle Hum
- 10.27 Identify considerations to installing outdoor speakers
- 10.28 Conduct a preliminary premise wiring check
- 10.29 Identify useful items used in the Trim-out phase
- 10.30 Identify the voltmeter as a tool for checking wire continuity
- 10.31 Define that tape protects stripped wire ends
- 10.32 Define the importance of not leaving valuable audio devices at the job site
- 10.33 Define that speakers should be checked before installing volume controls
- 10.34 Connect a distribution module to speakers and volume controls
- 10.35 Identify the components needed for IR media send and receive
- 10.36 Conduct a punch-down of an A-Bus module
- 10.37 Connect and test A-Bus for continuity
- 10.38 Wire a cable outlet to a coaxial cable
- 10.39 Define special considerations used when wiring the home theater in terms of:
 - 10.39.1 Central Consolidation Point
 - 10.39.2 Center channel location
 - 10.39.3 Subwoofer location
 - 10.39.4 Alternative surround locations

Module 11 Setup and Troubleshooting

In this module, students will perform system setup and turn-on and will be familiarized with the trouble shooting and maintenance of home entertainment systems.

Objectives:

- 11.1 Identify how to activate the Multi-room system
- 11.2 Identify how to activate the home theater system
- 11.3 Identify how to adjust a color TV display for
 - 11.3.1 Black level
 - 11.3.2 Contrast
 - 11.3.3 Color Saturation
- 11.4 Define an effective troubleshooting technique as working backwards—the process of elimination
- 11.5 Locate, using logical processes, the fault causing the audio problem based on:
 - 11.5.1 The nature of the problem
 - 11.5.2 The site of the problem
- 11.6 Explain how to correct an out-of-phase problem
- 11.7 Diagnose and correct a problem of buzzing from a ceiling speaker
- 11.8 Detect and correct a channel inversion problem
- 11.9 Identify that amplifiers can be auto protected
- 11.10 Describe four possible causes of a system shutdown as:
 - 11.10.1 Impedance
 - 11.10.2 Volume
 - 11.10.3 Thermal problems
 - 11.10.4 AC power
- 11.11 Identify troubleshooting system components that use A-Bus with Cat 5 UTP
- 11.12 Identify software packages that aid in the installation of home audio systems
- 11.13 Define how to isolate and correct video display problems of:
 - 11.13.1 Poor picture quality
 - 11.13.2 No picture on display
- 11.14 Identify the use of Known-Good cables as a means of video troubleshooting Identify poorly attached coaxial as a common cause of poor image quality



COLORADO SPRINGS SCHOOL DISTRICT 11
Achievement, Learning & Leadership

NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022

HIGH SCHOOL LEVEL

Course Name:	IB Spanish 7 HL & IB Spanish 8 HL
Course Codes:	FL.IBSP7HL, FL.IBSP8HL
State Course Code:	24063
Subject/Department:	Spanish/Foreign Languages
Course Length:	One (1) Semester Each
Grade:	9-12
Prerequisite:	Spanish 5/6 SL, teacher recommendation, or proficiency assessment
Credits per Semester:	1 Humanities or 1 Elective
Course Description:	<p>At a higher level, students are expected to extend the range and complexity of the language they use and understand to communicate. They continue to develop their knowledge of vocabulary and grammar as well as their conceptual understanding of how language works, to construct, analyze and evaluate arguments on a variety of topics relating to course content in the content language culture(s). Students will use receptive, production, and interactive skills to help negotiate meaning through an oral exchange, written expression, and spoken and written authentic text types. In the HL course, students will analyze two different literary works relating to the culture(s) of the language. The analysis of these literary works will be used for the internal assessment (individual oral assessment). This course is the first year of two years of higher-level study. The 7/8-year students will focus on thematic units and text types along with at least one of the two literary works.</p>



Instructions for content facilitator:

Please fill out the course information referencing the request submission. Add any comments needed and sign. Then route to secondary EDSL for signature. Once signature have been obtained, submit to the Director of Curriculum and Instruction; Achievement, Learning and Leadership for final review.

Cut and paste information from the request form here:

Content Facilitator Name/Role: Claudette Murtha – Global Education Facilitator	Content Area: World Language	Date: 9/21/2021
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If this request originated by a staff member other than the content facilitator listed, please list their name and role or leave blank. Carolyn Moyer – DP/IB Coordinator – Palmer High School

Course Title (if this is a deletion request, provide the current details): IB Spanish 7 HL

Course Length: 1 Semester

If this is a change, what is the New Course Length: N/A

Course Code: FL.IBSP7HL

State Course Code/SCED: 24063

Subject/Department: World Language

Grade: 9-12

Prerequisite: Spanish 5/6 SL, teacher recommendation or proficiency assessment

Credits per Semester: 1 Humanities or 1 Elective

If this is a change, what are the new Credits per Semester? N/A

Course Description:

At Higher Level, students are expected to extend the range and complexity of the language they use and understand to communicate. They continue to develop their knowledge of vocabulary and grammar as well as their conceptual understanding of how language works, to construct, analyze and evaluate arguments on a variety of topics relating to course content in the content language culture(s). Students will use receptive, production and interactive skills to help negotiate meaning through oral exchange, written expression and spoken and written authentic text types. In the HL course students will analyze two different literary works relating to the culture(s) of the language. The analysis of these literary works will be used for the internal assessment (individual oral assessment). This course is the first year of two years of the higher-level study. In the 7/8-year students will focus on thematic units and text types along with at least one of the two literary works.

If this is a change, what is the new Course Description? N/A

NEW COURSE OR COURSE CHANGE REQUEST

RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?
---	--

The Director of Curriculum and Instruction:	
Name: KAROL GATES	Date: 3-1-2022
Signature: 	
RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?



Instructions for content facilitator:

Please fill out the course information referencing the request submission. Add any comments needed and sign. Then route to secondary EDSL for signature. Once signature have been obtained, submit to the Director of Curriculum and Instruction; Achievement, Learning and Leadership for final review.

Cut and paste information from the request form here:

Content Facilitator Name/Role: Claudette Murtha – Global Education Facilitator	Content Area: World Language	Date: 9/21/2021
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If this request originated by a staff member other than the content facilitator listed, please list their name and role or leave blank. Carolyn Moyer – DP/IB Coordinator – Palmer High School

Course Title (if this is a deletion request, provide the current details): IB Spanish 8 HL

Course Length: 1 Semester

If this is a change, what is the New Course Length: N/A

Course Code: FL.IBSP8HL

State Course Code/SCED: 24063

Subject/Department: World Language

Grade: 9-12

Prerequisite: Spanish 5/6 SL, teacher recommendation or proficiency assessment

Credits per Semester: 1 Humanities or 1 Elective

If this is a change, what are the new Credits per Semester? N/A

Course Description:

At Higher Level, students are expected to extend the range and complexity of the language they use and understand to communicate. They continue to develop their knowledge of vocabulary and grammar as well as their conceptual understanding of how language works, to construct, analyze and evaluate arguments on a variety of topics relating to course content in the content language culture(s). Students will use receptive, production and interactive skills to help negotiate meaning through oral exchange, written expression and spoken and written authentic text types. In the HL course students will analyze two different literary works relating to the culture(s) of the language. The analysis of these literary works will be used for the internal assessment (individual oral assessment). This course is the first year of two years of the higher-level study. In the 7/8-year students will focus on thematic units and text types along with at least one of the two literary works.

If this is a change, what is the new Course Description? N/A

NEW COURSE OR COURSE CHANGE REQUEST

RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?
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The Director of Curriculum and Instruction:

Name: KAROL GATES

Date: 3-1-2022

Signature: 

RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?
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COLORADO SPRINGS SCHOOL DISTRICT 11
Achievement, Learning & Leadership

NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022

HIGH SCHOOL LEVEL

Course Name:	IB Spanish 9 HL & IB Spanish 10 HL
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Course Description:	<p>At a higher level, students are expected to extend the range and complexity of the language they use and understand to communicate. They continue to develop their knowledge of vocabulary and grammar as well as their conceptual understanding of how language works, to construct, analyze and evaluate arguments on a variety of topics relating to course content in the content language culture(s). Students will use receptive, production, and interactive skills to help negotiate meaning through an oral exchange, written expression, and spoken and written authentic text types. In the HL course, students will analyze two different literary works relating to the culture(s) of the language. The analysis of these literary works will be used for the internal assessment (individual oral assessment). This course is the first year of two years of higher-level study. The 7/8-year students will focus on thematic units and text types along with at least one of the two literary works.</p>



Instructions for content facilitator:

Please fill out the course information referencing the request submission. Add any comments needed and sign. Then route to secondary EDSL for signature. Once signature have been obtained, submit to the Director of Curriculum and Instruction; Achievement, Learning and Leadership for final review.

Cut and paste information from the request form here:

Content Facilitator Name/Role: Claudette Murtha/Global Education Facilitator	Content Area: World Language	Date: 9/17/2021
If this request originated by a staff member other than the content facilitator listed, please list their name and role or leave blank. Carolyn Moyer, IB Coordinator, Palmer High School		

Course Title (if this is a deletion request, provide the current details):

IB Spanish 9 HL

Course Length: 1 Semester

Course Code: FL.IBSP9HL

State Course Code/SCED: 24063

Subject/Department: World Language

Grade: 9-12

Prerequisite: Spanish 7/8 HL, teacher recommendation or proficiency assessment

Credits per Semester: 1 Humanities or Elective

If this is a change, what are the new Credits per Semester? N/A

Course Description: At a higher level, students are expected to extend the range and complexity of the language they use and understand to communicate. They continue to develop their knowledge of vocabulary and grammar as well as their conceptual understanding of how language works, to construct, analyze and evaluate arguments on a variety of topics relating to course content in the content language culture(s). Students will use receptive, production and interactive skills to help negotiate meaning through oral exchange, written expression and spoken authentic text types. In the HL course students will analyze two different literary works relating to the culture(s) of the language. The analysis of these literary works will be used for the internal assessment (individual oral assessment). In this year, students will focus on both literary works and a deeper understanding of how these works apply to the thematic units, text types and global context of IB.

NEW COURSE OR COURSE CHANGE REQUEST

RECOMMEND ☐	DO NOT RECOMMEND ☐ Why?
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The Director of Curriculum and Instruction:

Name: Karol Gates

Date:

Signature:



3-1-2022

RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?
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Instructions for content facilitator:

Please fill out the course information referencing the request submission. Add any comments needed and sign. Then route to secondary EDSL for signature. Once signature have been obtained, submit to the Director of Curriculum and Instruction; Achievement, Learning and Leadership for final review.

Cut and paste information from the request form here:

Content Facilitator Name/Role: Claudette Murtha/Global Education Facilitator	Content Area: World Language	Date: 9/17/2021
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If this request originated by a staff member other than the content facilitator listed, please list their name and role or leave blank. Carolyn Moyer, IB Coordinator, Palmer High School

Course Title (if this is a deletion request, provide the current details):

IB Spanish 10 HL

Course Length: 1 Semester

Course Code: FL.IBSP10HL

State Course Code/SCED: 24063

Subject/Department: World Language

Grade: 9-12

Prerequisite: Spanish 7/8 HL, teacher recommendation or proficiency assessment

Credits per Semester: 1 Humanities or Elective

If this is a change, what are the new Credits per Semester? N/A

Course Description: At a higher level, students are expected to extend the range and complexity of the language they use and understand to communicate. They continue to develop their knowledge of vocabulary and grammar as well as their conceptual understanding of how language works, to construct, analyze and evaluate arguments on a variety of topics relating to course content in the content language culture(s). Students will use receptive, production and interactive skills to help negotiate meaning through oral exchange, written expression and spoken authentic text types. In the HL course students will analyze two different literary works relating to the culture(s) of the language. The analysis of these literary works will be used for the internal assessment (individual oral assessment). In this year, students will focus on both literary works and a deeper understanding of how these works apply to the thematic units, text types and global context of IB.

NEW COURSE OR COURSE CHANGE REQUEST

RECOMMEND ☐	DO NOT RECOMMEND ☐ Why?
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The Director of Curriculum and Instruction :	
Name: Karol Gates	Date:
Signature: 	3-1-22
RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?

Nature of the subject

Language acquisition

Language acquisition consists of two modern language courses—language ab initio and language B—that are offered in a number of languages, and a classical languages course that is offered in Latin and Classical Greek. Owing to the nature of language study in the latter, there are specific aims for classical literature that can be found in the *Classical languages guide*. Language ab initio and language B are language acquisition courses designed to provide students with the necessary skills and intercultural understanding to enable them to communicate successfully in an environment where the language studied is spoken. This process allows the learner to go beyond the confines of the classroom, expanding their awareness of the world and fostering respect for cultural diversity.

The two modern language courses—language ab initio and language B—develop students' linguistic abilities through the development of receptive, productive and interactive skills (as defined in the "Syllabus content" section). The classical languages course focuses on the study of the language, literature and culture of the classical world.

Language B SL and language B HL

Language B is a language acquisition course designed for students with some previous experience of the target language. In the language B course, students further develop their ability to communicate in the target language through the study of language, themes and texts. In doing so, they also develop conceptual understandings of how language works, as appropriate to the level of the course.

Most language B subjects are available at both SL and HL. A list of languages offered at language B SL and HL is released each year in the *Diploma Programme Assessment procedures*.

Distinction between SL and HL

At both levels of language B (SL and HL), students learn to communicate in the target language in familiar and unfamiliar contexts. They describe situations, narrate events, make comparisons, explain problems, and state and support their personal opinions on a variety of topics relating to course content. The study of two literary works originally written in the target language is required only at language B HL. The distinction between language B SL and HL can also be seen in the level of competency the student is expected to develop in the receptive, productive and interactive skills described below.

Language B SL

Receptive skills: Students understand a range of written and spoken authentic personal, professional and mass media texts on topics of interest. They understand descriptions of events, feelings and wishes; they understand comparisons and recognize a straightforward, linear argument. They use context to deduce the meaning of sentences and unknown words and phrases.

Assessment objectives

The following assessment objectives are common to both language B and language ab initio. The level of difficulty of the assessments, and the expectations of student performance on the tasks, are what distinguishes the three modern language acquisition courses.

1. Communicate clearly and effectively in a range of contexts and for a variety of purposes.
2. Understand and use language appropriate to a range of interpersonal and/or intercultural contexts and audiences.
3. Understand and use language to express and respond to a range of ideas with fluency and accuracy.
4. Identify, organize and present ideas on a range of topics.
5. Understand, analyse and reflect upon a range of written, audio, visual and audio-visual texts.

IB SPANISH LANGUAGE B

William Palmer High School

Colorado Springs, District 11

COURSE DESCRIPTION:

Spanish Language B SL including ab initio: The goal of the courses is to prepare students to communicate effectively in Spanish, in a wide-range of authentic situations and to a range of audiences, in both spoken and written form. They will also expand their comprehension of the language by reading a wide variety of texts and listening to audio recordings by native speakers. The aim is not only to prepare students in order to succeed in the IB program, but to also lay a foundation that will help them further their learning of the language in the future.

Through the language, students will be exposed to the ideas and nuances of the Hispanic culture. The hope is that students develop an appreciation of the richness and diversity of the language and culture, an awareness of what happens around them, and an open mind to consider and respect perspectives different than their own. Therefore, this class is also connected to TOK, ATLs, and CAS since students are expected to develop understandings regarding their ways of knowing, their ideals, and their role in a world that is interconnected more than ever before.

Language B HL: this course is designed for students who have a command of the language sufficient to follow university courses in other disciplines in the language B that is studied. The ultimate goal is to provide HL students with a basis for further study, work, and leisure through the use of an additional language. In addition to IB regular assessments, Language B Higher level students have to analyze a minimum of two authentic works of literature and have a recommended minimum of 240 hours of class time. Higher and standard levels are differentiated by the recommended teaching hours, the depth of syllabus coverage, the required study of literature at (HL), and the level of difficulty and requirements of the assessment tasks and criteria according to IB requirements. The course is organized into themes: Language and identity, social organization, experiences, innovation, and sharing the planet.

The literary texts will be varied according to theme/students' interests/language proficiency...etc. We will only use literary texts approved by the district.

The following is the sequence for Spanish 7,8 HL and 9,10 SL and HL.

Social Organization	<p>Social relations: the social-self</p> <p>Law and Order</p> <p>Education and equality</p> <p>discrimination</p> <p>HL Literature:</p> <p>"Los de abajo"</p> <p>Mariano Azuela</p> <p>or</p> <p>"El llano en llamas" Juan Rulfo</p> <p>Poesia: "Los enemigos" Neruda (IB text p.65)</p> <p>Text: announcement/interview</p> <p>Examen IB: Reading</p>	<p>Phrases to give and ask for opinions, to participate in a debate or exchange of ideas, to agree or disagree respectfully.</p>	<p>What is the role of the individual in society?</p> <p>What role does education play in achieving social change?</p> <p>What are some societies more stable than others?</p> <p>Is the pursuit of happiness a right or privilege?</p> <p>Why do we have laws? Should we protest against injustice?</p> <p>How is the cultural context of the work you are studying revealed?</p> <p>What is the main aim of the work that you are studying? How do you know this?</p> <p>How accessible is this work to you as a reader?</p> <p>What might prevent a reader understanding this work?</p>
Experiences	<p>Family Customs and Traditions</p> <p>Celebrations</p> <p>HL</p> <p>"La casa en Mango Street"</p> <p>Sandra Cisneros</p> <p>Writing Strategies</p> <p>Texts: presentation/informal letter or email</p>	<p>Vocabulary to describe a tradition and to explain the connection between this tradition and the values of the specific culture.</p>	<p>How and why do different cultures mark important moments in life?</p> <p>How maintaining traditions help preserve the culture?</p> <p>How is food related to culture and geographical location?</p> <p>What can you learn about the culture through food?</p> <p>HL</p> <p>How successfully has the work you are reading right now presented a particular point of view?</p> <p>Compare and contrast the literary work you are reading with a work of art.</p>
Human Ingenuity	<p>Technological and Scientific innovation</p> <p>Text: article</p> <p>Listening strategies IB</p> <p>Listening Assessment</p> <p>HL readings IB textbook</p>	<p>Review</p> <p>Past tense</p> <p>Impersonal sentences</p> <p>Prepositional phrases</p> <p>Relative pronouns</p>	<p>How do the developments in science and technology influence our lives and the lives of others?</p> <p>Do you think Hispanic countries create their own technology?</p> <p>In your opinion, are science and technology dangerous?</p> <p>How do robotics improve the quality of life?</p>

	<p>HL to teach the class- juegos populares/ Juegos autóctonos</p> <p>HL: <i>La Guerra Civil española</i></p> <p>HL Literatura:</p> <p>Ana María Matute, "<i>El niño al que se le murió el amigo</i>"; "<i>El árbol de oro</i>".</p> <p>IB Text: Interview (research and role play) a famous person or a person you know who has an interesting life story.</p> <p>Assessment: IB reading exam</p>		<p>What can we learn from personal stories of resilience?</p> <p>HL</p> <p>How similar is the world in the work you are reading to the real world?</p> <p>What makes an issue a 'global issue'?</p> <p><u>HL Posibles obras para estudiar</u></p> <p>Poesía: Federico García Lorca; Pablo Neruda; José Martí</p> <p>Drama:</p> <p>"<i>La casa de Bernarda de Alba</i>" de García Lorca</p> <p>Narrativa:</p> <p>Alejo Carpentier, "<i>El reino de este mundo</i>"</p> <p>"<i>La aventura de Said</i>", Josep Lorman</p>
Human Ingenuity	<p>Art and social change.</p> <p>IB TEXT: <i>Análisis de obras de arte durante la guerra civil española</i>.</p> <p>Background: Trujillo's dictatorship in the Dominican Republic.</p> <p>Film: <i>En el tiempo de las mariposas</i>.</p>	<p>Continue using grammatical concepts already learned.</p> <p>Using perfect tenses</p> <p>*relative pronouns</p> <p>Review Using verbs like <i>gustar</i>-</p> <p>Indirect object pronouns</p>	<p>What is art?</p> <p>How do the arts help us understand the world?</p> <p>Is art a reflection or imitation of reality? * La creación artística, ¿expresa una visión personal del artista o refleja la cultura en que vive?</p> <p>¿Qué podemos aprender de una cultura a través de la expresión artística?</p> <p>How can artistic expressions bring about social change.</p>

	<p>The dictatorship of ignorance.</p> <p>Text: formal letter</p> <p>HL: Short essay analyzing novel</p> <p>Assessment: Oral exam</p>		<p>Consider to what extent you have identified with or felt challenged by perspectives offered in the works you have read.</p> <p>Compare two works that you have read in the course. How does comparing them change how you understand each work? How do the works seem different after this comparison?</p>
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COLORADO SPRINGS SCHOOL DISTRICT 11
Achievement, Learning & Leadership

**NEW SECONDARY COURSE
REQUEST FOR APPROVAL
SPRING 2022**

HIGH SCHOOL LEVEL

Course Name: IB Math Applications Higher Level 1
IB Math Applications Higher Level 2
IB Math Applications Higher Level 3
IB Math Applications Higher Level 4

Course Codes: MA.IBAP1HL, MA.IBAP2HL
MA.IBAP3HL, MA.IBAP4HL

State Course Code: 02139

Subject/Department: Mathematics

Course Length: One (1) Semester

Grade: 9-12

Prerequisite: IBMYP Advanced Algebra

Credits per Semester: (1) Mathematics (MA), or Elective (EL)

Course Description: The number and algebra HL looks at: laws of logarithms, complex numbers and their practical applications, matrices and their applications for solving systems of equations, for geometric transformations, and their applications to probability. The functions HL looks at: use of log-log graphs, graph transformations, creating, fitting, and using models with further trigonometric, logarithmic, rational, logistic, and piecewise functions. The geometry and trigonometry HL looks at: vector concepts and their applications in kinematics, applications of adjacency matrices, and tree and cycle algorithms. The statistics and probability HL looks at: the binomial and Poisson distributions, designing data collection methods, tests for reliability and validity, hypothesis testing, and confidence intervals. The calculus HL looks at: kinematics and practical problems involving rates of change, volumes of revolution, setting up and solving models involving differential equations using numerical and analytic methods, slope fields, coupled and second-order differential equations in context.



NEW COURSE OR COURSE CHANGE REQUEST

Instructions for content facilitator:

Please fill out the course information referencing the request submission. Add any comments needed and sign. Then route to secondary EDSL for signature. Once signature have been obtained, submit to the Director of Curriculum and Instruction; Achievement, Learning and Leadership for final review.

Cut and paste information from the request form here:

Content Facilitator Name/Role: Paul Bunge – K12 Math/STEM Facilitator	Content Area: Mathematics	Date: 2/7/2022
If this request originated by a staff member other than the content facilitator listed, please list their name and role or leave blank. Eric McNeil, Math teacher at Palmer High School		

Course Title (If this is a deletion request, provide the current details):

IB Math Applications HL 1, IB Math Applications HL 2, IB Math Applications HL 3, IB Math Applications HL 4

Course Length: Semester

If this is a change, what is the New Course Length:

Course Code: MA.IBAP1HL, MA.IBAP2HL, MA.IBAP3HL, MA.IBAP4HL

State Course Code/SCED: 02139

Subject/Department: Mathematics, IB

Grade: 9-12

Prerequisite: IBMYP Advanced Algebra

Credits per Semester: One (1) - Mathematics (Required)

(example: One (1) Humanities or Elective)

If this is a change, what are the new Credits per Semester?

(example: One (1) Humanities, Practical Arts, Postsecondary Workforce Readiness (2021+), or Elective Credit

Course Description:

The number and algebra HL looks at: laws of logarithms, complex numbers and their practical applications, matrices and their applications for solving systems of equations, for geometric transformations, and their applications to probability.

The functions HL looks at: use of log-log graphs, graph transformations, creating, fitting and using models with further trigonometric, logarithmic, rational, logistic and piecewise functions.

The geometry and trigonometry HL looks at: vector concepts and their applications in kinematics, applications of adjacency matrices, and tree and cycle algorithms.

The statistics and probability HL looks at: the binomial and Poisson distributions, designing data collection methods, tests for reliability and validity, hypothesis testing and confidence intervals.

NEW COURSE OR COURSE CHANGE REQUEST

Name: DAN HOFF		Date: 02/24/22
Signature: 		
RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?	

The Director of Curriculum and Instruction:		
Name: KAROL GATES		Date: 3-1-2022
Signature: 		
RECOMMEND ☒	DO NOT RECOMMEND ☐ Why?	

Aims

The aims of all DP mathematics courses are to enable students to:

1. develop a curiosity and enjoyment of mathematics, and appreciate its elegance and power
2. develop an understanding of the concepts, principles and nature of mathematics
3. communicate mathematics clearly, concisely and confidently in a variety of contexts
4. develop logical and creative thinking, and patience and persistence in problem solving to instil confidence in using mathematics
5. employ and refine their powers of abstraction and generalization
6. take action to apply and transfer skills to alternative situations, to other areas of knowledge and to future developments in their local and global communities
7. appreciate how developments in technology and mathematics influence each other
8. appreciate the moral, social and ethical questions arising from the work of mathematicians and the applications of mathematics
9. appreciate the universality of mathematics and its multicultural, international and historical perspectives
10. appreciate the contribution of mathematics to other disciplines, and as a particular “area of knowledge” in the TOK course
11. develop the ability to reflect critically upon their own work and the work of others
12. independently and collaboratively extend their understanding of mathematics.

Assessment objectives in practice

Assessment objectives	Paper 1 %	Paper 2 %	Paper 3 % HL only	Exploration %
Knowledge and understanding	20-30	20-30	10-20	5-15
Problem solving	20-30	20-30	20-30	5-20
Communication and interpretation	20-30	20-30	20-30	15-25
Technology	20-35	20-35	10-30	10-20
Reasoning	5-15	10-20	10-20	5-25
Inquiry approaches	5-15	5-20	15-30	25-35

Prior learning topics

Prior to starting a DP mathematics course students have extensive previous mathematical experiences, but these will vary. It is expected that mathematics students will be familiar with the following topics before they take the examinations because questions assume knowledge of them. Teachers must therefore ensure that any topics listed here that are unknown to their students at the start of the course are included at an early stage. Teachers should also take into account the existing mathematical knowledge of their students to design an appropriate course of study for mathematics. This table lists the knowledge, together with the syllabus content, that is essential for successful completion of the mathematics course.

Number and algebra

- Number systems: natural numbers $\mathbb{N}$; integers, $\mathbb{Z}$; rationals, $\mathbb{Q}$, and irrationals; real numbers, $\mathbb{R}$
- SI (Système International) units for mass, time, length and their derived units, eg. speed, area and volume
- Rounding, decimal approximations and significant figures, including appreciation of errors
- Definition and elementary treatment of absolute value (modulus), $|a|$
- Use of addition, subtraction, multiplication and division using integers, decimals and fractions, including order of operations
- Prime numbers, factors (divisors) and multiples
- Greatest common factor (divisor) and least common multiples (HL only)
- Simple applications of ratio, percentage and proportion
- Manipulation of algebraic expressions, including factorization and expansion
- Rearranging formulae
- Calculating the numerical value of expressions by substitution
- Evaluating exponential expressions with simple positive exponents
- Evaluating exponential expressions with rational exponents (HL only)
- Use of inequalities, $<$, $\leq$, $>$, $\geq$, intervals on the real number line
- Simplification of simple expressions involving roots (surds or radicals)
- Rationalising the denominator (HL only)
- Expression of numbers in the form $a \times 10^k$, $1 \leq a < 10$, $k \in \mathbb{Z}$
- Familiarity with commonly accepted world currencies
- Solution of linear equations and inequalities
- Solution of quadratic equations and inequalities with rational coefficients (HL only)
- Solving systems of linear equations in two variables
- Concept and basic notation of sets. Operations on sets: union and intersection
- Addition and subtraction of algebraic fractions (HL only).

Functions

- Graphing linear and quadratic functions using technology
- Mappings of the elements of one set to another. Illustration by means of sets of ordered pairs, tables, diagrams and graphs.