



Approved Innovative Course

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Course: *Fiber Optic Technician*

PEIMS Code:

Abbreviation:

Grade Level(s): 11-12

Number of Credits: 1.0

Course description:

Through a challenging curriculum encompassing design, installation, repair, and maintenance of high speed data systems, students gain the knowledge and skills necessary to become employed in a number industries. The Fiber Optic Technician hands-on training covers premise wiring used in industrial, commercial, and residential networks and how to terminate, test, troubleshoot, and repair fiber optic cables and network devices. Students concentrate on the installation, service, and maintenance of high-speed data infrastructures.

Essential knowledge and skills:

- (a) General requirements. This course is recommended for students in Grades 11-12. Recommended prerequisites: : Principles of Information Technology or Principles of Construction . Students shall be awarded one credit for successful completion of this course
- (b) Introduction.
 - (1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.
 - (2) The Information Technology (IT) Career Cluster focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services.
 - (3) Through a challenging curriculum encompassing design, installation, repair, and maintenance of high speed data systems, students gain the knowledge and skills necessary to become employed in a number industries. The Fiber Optic Technician hands- on training covers premise wiring used in industrial,



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commercial, and residential networks and how to terminate, test, troubleshoot, and repair fiber optic cables and network devices. Students will concentrate on the installation, service, and maintenance of high-speed data infrastructures.

- (4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations
- (5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

- (1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:
 - (A) identify and demonstrate positive work behaviors that enhance employability and job advancement such as regular attendance, promptness, attention to proper attire, maintenance of a clean and safe work environment, appropriate voice, and pride in work;
 - (B) identify and demonstrate positive personal qualities such as personal integrity, flexibility, open-mindedness, initiative, listening attentively to speakers, and willingness to learn new knowledge and skills;
 - (C) employ effective reading and writing skills;
 - (D) solve problems and think critically;
 - (E) demonstrate leadership skills and function effectively as a team member;
 - (F) identify and implement proper safety procedures;
 - (G) demonstrate an understanding of legal and ethical responsibilities in relation to the field of information technology; and
 - (H) demonstrate planning and time-management skills.
- (2) The student identifies various employment opportunities in the information technology field. The student is expected to:
 - (A) develop a personal career plan that addresses education, job skills, and experience necessary to achieve career goals;
 - (B) develop a resume and portfolio appropriate to chosen career plan;
 - (C) practice interview skills for successful job placement.
- (3) The student applies communication, mathematics, English language arts, and science knowledge and skills to research and develop projects. The student is expected to:
 - (A) demonstrate proper use of written, verbal, and visual communication techniques consistent with networking industry standards;



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- (B) demonstrate proper use of mathematics concepts in the development of networking technologies; and
- (C) demonstrate proper use of science principles in the development of networking technologies.
- (4) The student analyzes the characteristics of the cabling system. The student is expected to:
- (A) analyze the installation plans, type of structure, and equipment when determining which cabling system(s) should be used;
- (B) explain and apply the industry vocabulary and standards;
- (C) identify communications systems used in structured cabling systems;
- (D) explain and analyze the generic use of cabling;
- (E) evaluate communication system requirements;
- (F) design and layout a cable plant properly, including proposing the typology, calculating a loss budget, and maintaining the appropriate; and
- (G) evaluate Material Safety Data Sheets (MSDS) and building codes; including regulations for grounding, bonding and fire stopping.
- (5) The student explores the different types of copper cabling systems. The student is expected to:
- (A) distinguish between and evaluate the legacy copper systems;
- (B) apply copper [systems?] vocabulary and terminology appropriately;
- (C) identify and explain the different types of connectors and how they are used in a project;
- (D) evaluate Power over Ethernet (PoE) and devices that use that technology;
- (E) practice termination and splicing; including choosing the correct connector or splicing device, prepping the cable, using the appropriate tools and equipment, and testing the installation;
- (F) testing the performance requirements for Unshielded Twisted Pair (UTP); including cable certification, verification, and troubleshooting;
- (G) evaluate the use of con analyze the design, layout, and implementation of a copper structured cable data system including data, Plain Old Telephone Service (POTS), security, and coaxial system; figuration software associated with wired systems and diagnose copper network systems;
- (H) analyze the design, layout, and implementation of a structured cable system, including POTS, security, and coaxial systems; and
- (I) demonstrate the skills and abilities necessary to setup and test a structured cabling system.
- (6) The student demonstrates the safety requirements associated with the tools, equipment, and field procedures associated with the fiber optic cable technology and installation. The student is expected to:
- (A) explain eye safety procedures;



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- (B) demonstrate hand, power, and pneumatic tool safety;
 - (C) follow safety procedures when working from heights such as from a ladder, scaffolding, aerial work platform, and boom-trucks;
 - (D) discuss confined space safety procedures;
 - (E) interpret Hazard Communication (HazCom) standard requirements including (MSDS); and
 - (F) summarize ergonomic principles and safe material handling practices.
- (7) The student evaluates and analyses different wireless technologies and architectures. The student is expected to:
- (A) evaluate the effectiveness of wireless technologies and how they compare to structured wiring systems;
 - (B) apply wireless system standards and vocabulary appropriately;
 - (C) explain how communication systems use wireless technology;
 - (D) analyze the wiring typologies in a telecommunication system;
 - (E) evaluate the configuration software used to setup a wireless system;
 - (F) analyze the design, layout and implementation of wireless data systems and its components, including wireless access points, cameras, and over the air video; and
 - (G) demonstrate the skills and abilities necessary to setup and test a structured cabling system.
- (8) The student evaluates the uses of fiber optics and what applications fiber optics support. The student is expected to:
- (A) research and evaluate the different industries that utilize fiber optics;
 - (B) apply fiber optics standards and vocabulary appropriately;
 - (C) explain and review the metric system; and
 - (D) break down how communication systems use light to transfer information.
- (9) The student analyzes the physical components of a fiber optic system. The student is expected to:
- (A) evaluate the different components and functions of a datalink transmission system, including sources such as Light-Emitting Diode (LED) and Laser Fabry Perot (FP), Distributed Feedback (DFB), Vertical-Cavity Surface-Emitting Laser (VCSEL) and detectors such as photodiode and Avalanche Photodiode (APD), composed of Silicon (Si), Germanium (Ge), and Indium Gallium Arsenide (InGaAs);
 - (B) analyze the types of optical fiber: Multi-Mode (MM), grades index MM, Single Mode (SM), and specialty fibers;
 - (C) analyze the basic specifications that affect transmission of data, including attenuation and dispersion; and
 - (D) evaluate how to choose the appropriate fiber for a particular system.



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- (10) The student analyzes, evaluates, and demonstrates use of fiber optic cables and their applications. The student is expected to:
- differentiate between the different type of cables such as tight buffer (Simplex, zipcord, distribution, and breakout); loose tube (including ribbon); and specialty (AlumaCore Optical Ground Wire (OPGW) and underwater);
 - analyze relevant specifications for fiber optics applications such as water blocking, pull strength, and armoring;
 - identify and select the correct cable to be used based on the application.
- (11) The student demonstrates the ability to terminate and splice fiber optic cable. The student is expected to:
- evaluate different termination and splicing techniques for effectiveness;
 - evaluate cable performance such as loss, reflectance, and strength;
 - evaluate the effectiveness of the tools used in the termination process;
 - identify the hardware and termination connector types such as Straight Tip (ST), Subscriber Connector (SC), Lucent Connector (LC), Multi-Fiber Push-on (MTP), and legacy connectors;
 - evaluate the splicing processes, including mechanical, fusion, and mass (ribbon) fusion processes; and
 - demonstrate termination techniques, including adhesive connectors with mechanical splices (epoxy, anaerobic, and hot melt), the pre-polish splicing system, and the Prefab technique.
- (12) The student analyzes and demonstrates the use of fiber optic testing. The student is expected to:
- evaluate the cable design including loss budget;
 - perform a pre-inspection using light or microscope inspection techniques to determine if the cable or termination is defective;
 - determine which diagnostic method will be used to evaluate performance without Optical Time-Domain Reflectometer (OTDR) equipment
 - evaluate visual tracing and fault location for defects;
 - analyze long haul Single Mode (SM) testing for Chromatic Dispersion (CD) and Polarization Mode Dispersion (PMD);
 - evaluate insertion loss testing results and determine if connectors or splicing techniques are within loss budget calculations;
 - use OTDR to determine a breakage in line or damaged cable;
 - determine break location including distance and location of defective cable component; and
 - verify budget loss and check speed of connection.
- (13) The students designs and analyzes a fiber optic network system. The student is expected to:



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- (A) evaluate communications system requirements based on industry recognized loss budget allowances;
 - (B) design and lay out a cable plant that is in accordance to industry standards;
 - (C) determine the proper components for the plant design;
 - (D) analyze the loss of power budget of the plant design; and
 - (E) document the proposed plant design.
- (14) The student examines the ethics and legal parameters in the telecommunication industry and understands that workers must abide by local, state, and federal laws. The student is expected to:
- (A) analyze ethical standards in the telecommunications field;
 - (B) describe telecommunications organizational policies and procedures;
 - (C) distinguish between ethical and unethical business practices; and
 - (D) contrast ethical, moral, and legal choices that relate to the decision-making process in business situations.

Description of specific student needs this course is designed to meet:

With only 11% of Texas households and commercial buildings connected to fiber, Texas ranks 46th in the country with one of the lowest number of connected buildings. In opposition, the fiber optic infrastructure is at the core of advanced manufacturing, telemedicine, finance, e-commerce, social media, gaming, and cloud-based applications. Fiber is also used in other industries that are foundational to Texas, which includes process control of oil and gas, wind turbines, and data centers. As a consumer of these services, 21st century learners are uniquely qualified and, therefore, can directly relate to these cutting-edge services. The proposed Fiber Optic Installation training includes the steps required to support this industry. Technicians are needed across a wide variety of high tech jobs, including green energy, oil and gas, advanced manufacturing, information technology, data centers, and the networks that enable our mobile phones, gaming systems, and computers to connect to the internet.

Students that complete the course, may sit for the Fiber Optic Association (FOA) internationally recognized certifications including the Certified Premise Cabling Technician (CPCT) and Certified Fiber Optic Technician (CFOT) tests which may result in direct employment opportunities with local telecommunication businesses.



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Major resources and materials:

Fiber Optic Association (<http://www.thefoa.org/>)

Text Books:

1. Hayes, J. (2010). *The FOA reference guide to premises cabling and study guide to FOA certification* / Jim Hayes. Fallbrook, CA: Fiber Optic Association. (ISBN 1450559662)
2. Hayes, J. (2014). *The FOA reference guide to fiber optics and study guide to FOA certification*. Fallbrook, CA: Fiber Optic Association. (1-4392-5387-0)

Website Resources: <http://www.thefoa.org/Lennie>

<http://www.thefoa.org/Ted/>

<https://www.youtube.com/user/thefoainc>

<http://itunes.apple.com/us/app/foa-guide/id434354283?mt=8&ign-mpt=uo%3D4>

Recommended course activities:

Research

Reviewing safety materials

Industry representative

Create project plans

Evaluate laws governing industry

Job shadowing of a communication technician

Employability skills including mock interviews

Resume creation

Lab Activities:

- Identification of different cables used in class;
- Practice of laying cables in trays and J-hooks;
- Practice terminations and splicing of copper and fiber cables;
- Testing of cables, splices and terminations (certification, verification, and TDR/OTDR);
- Mounting load center components including grounding/bonding, NIU, and distribution equipment;
- Creating a system with wireless, copper wired and fiber connections.



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Suggested methods for evaluating student outcomes:

Student outcomes may be evaluated through classroom and homework assignments, independent and group projects, teacher made exams and simulation/ performance based assignments. Additionally, students will create and maintain portfolios of their work containing but not limited to written papers, online learning, quizzes, written and practical examinations.

Teacher qualifications:

Any business or office education certificate.

Any home economics or homemaking certificate.

1-2 years as a Field or Instrumentation Technician.

Fiber Optic Association (CFOT) and (CPCT) certificate.

Additional information:

EDS Tech Training Sites (EDSTTS) is an FOA approved School.

EDSTTS is a Veteran owned and operated non-profit workforce development organization that specializes in training the under-employed in high demand occupations.

EDSTTS has Certified FOA Instructors that can be contracted to deliver or assist in the delivery of the material throughout Texas.

EDSTTS has termination/splicing equipment training kits that can be rented by a school.

EDSTTS can be contracted to deliver the FOA CPCT and CFOT certification tests at your location.