Computer Maintenance Technician

Office of the State Superintendent of Education
Postsecondary and Career Education Division
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The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the Computer Maintenance Technician Program of Study. The academic standards in this document are theoretical and performance-based. The standards contain content from Colorado, Maryland, Tennessee, and Texas and were validated by D.C. business and industry partners. All content is used with permission.

In addition to academic standards, OSSE has incorporated into this document Labor Market Information (LMI) definitions and explanations for the Program of Study; program aligned Industry Recognized Credentials; and Work-Based Learning resources and requirements by course level.

This document is intended for use by educational administrators and practitioners. A similar document is available for each state-approved CTE Program of Study

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Course Descriptions: Computer Maintenance Technician		
Course Level	**Course Information**	**Description**
Level I	**Principles of Information Technology** **OSSEID:** 10253G1.0014 **Grades:** 9-12 **Prerequisite:** None **Credit:** 1	In Principles of Information Technology, students will develop computer literacy skills to adapt to emerging technologies used in the global marketplace. Students will implement personal and interpersonal skills to prepare for a rapidly evolving workplace environment. Students will enhance reading, writing, computing, communication.
Level II	**Networking I** **OSSEID:** 10102G1.0024 **Grades:** 10-12 **Prerequisite:** Principles of Information Technology	The Networking I course is normally comprised of the courses called Cisco CCNA R&S: Introduction to Networks (CCNA 1) and Cisco CCNA R&S: Routing and Switching Essentials (CCNA 2). The Introduction to Networks course introduces the concept of Computer Maintenance Technician, using various analogies to help the student understand the movement of packets throughout the Internet, and the protocol standards used. The Routing and Switching course moves the student into the theory of "moving packets." The concepts of routing and switching "packets" to the correct destination is covered, and how a network administrator.
Level III	**Computer Maintenance** **OSSEID:** 10252G1.0034 **Grades:** 11-12 **Prerequisite:** Networking I **Credit:** 1	In Computer Maintenance, students will acquire knowledge of computer maintenance and creating appropriate documentation. Students will analyze the social responsibility of business and industry regarding the significant issues relating to the environment, ethics, health, safety, and diversity in society and in the workplace as related to computer maintenance. Students will apply technical skills to address the IT industry and emerging technologies.
Level IV	**Practicum in Computer Maintenance Technician** **OSSEID:** 10951G1.0044 **Grades:** 12 **Prerequisite:** Computer Maintenance **Credit:** 1	In the Practicum in Information Technology: Computer Maintenance Technician, students will gain advanced knowledge and skills in the application, design, production, implementation, maintenance, evaluation, and assessment of products, services, and systems. Knowledge and skills in the proper use of analytical skills and application of IT concepts and standards are essential to prepare students for success in a technology-driven society. Critical thinking, IT experience, and product development may be conducted in a classroom setting with an industry mentor, as an unpaid or paid internship, as part of a capstone project, or as career preparation.

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Industry Certifications

At the end of Computer Maintenance:
CompTIA IT Fundamentals+
CompTIA A+ CompTIA Security+

Work-Based Learning Examples and Resources

Level I Course	Level II Course	Level III Course	Level IV Course
Career Exploration Industry Visits Guest Speakers Participate in a CTSO	**Career Awareness** *All of Level I, plus:* Postsecondary Visits Program-Specific Site Tours Mock Interviews	**Career Preparation** *All of Level I and II, plus:* Job Shadow Paid/Unpaid Internships	**Career Preparation** Paid/Unpaid Internships Apprenticeships

Several resources are available to help instructors meet the Level I and Level II WBL requirements, including:

Career Coach DC (http://careercoachdc.emsicc.com). Online site designed to help students find and connect to a career pathway by providing the most current local data on wages, employment, job postings, and associated education and training. The resource includes a Career Assessment for students.

Nepris (https://dc.nepris.com/). Connects educators and learners with a network of industry professionals virtually, bringing real-world relevance and career exposure to all students. Nepris also provides a skills-based volunteering platform for business and industry professionals to extend their educational outreach.

Virtual Job Shadow (https://virtualjobshadow.com). Provides interactive tools which empower students to discover, plan, and pursue their dreams. Rich video library presents a "day in the life of" view for thousands of occupations.

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Labor Market Information Definitions and Data

Career and Technical Education programs of study in the District of Columbia must meet at least one of the High Wage, High Skill, and In-Demand definitions below to be considered appropriate for our students and the regional labor market. These definitions were created in collaboration with Career and Technical Education leaders from District of Columbia LEAs, the University of the District of Columbia Community College, and national guidance from Research Triangle International (RTI) and Education Northwest. Additionally, previous work was consulted by researchers at MIT's Labor Wage Index Project and the DC CTE Task Force's 2012 Strategic Plan for the District of Columbia.

Indicator	Definition	Data for the Computer Maintenance Technician Program of Study (source: EMSI, August 2022)
High Wage	Those occupations that have a 25th percentile wage equal to or greater than the most recent MIT Living Wage Index for one adult in the District of Columbia, and/or leads to a position that pays at least the median hourly or annual wage for the Washington, DC, metropolitan statistical area. *Note: A 25th percentile hourly wage of $23.13 or greater is required to meet this definition.*	**Standard Occupational Code (SOC):** 15-1232.00 Computer User Support Specialist **Hourly Wages** **25th Percentile:** $23.76 **50th Percentile:** $30.76 **75th Percentile:** $37.62
High Skill	Those occupations located within the Washington, DC, metropolitan statistical area with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, or higher.	**Typical Entry-Level Education:** Some college, no degree
In-Demand	Those occupations in the Washington, DC, metropolitan statistical area having more than the median number of total **(growth plus replacement)** annual openings over a five-year period. *Note: An occupation is required to have an annual growth plus replacement rate of 105 openings, or greater, between 2021-2026 to meet this definition.*	**Annual Openings:** 2,946

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Model Six-Year Plan: Computer Maintenance Technician

College: University of the District of Columbia Community College
Program/CIP:
Plan:

Entity: Office of the State Superintendent of Education
Career Cluster: Information Technology
Program of Study: Computer Maintenance Technician

Subject	High School				College			
	9th Grade	10th Grade	11th Grade	12th Grade	Semester I	Semester II	Semester III	Semester IV
English (4)	English I	English II	English III	English IV				
Math (4)	Algebra I	Geometry	Algebra II	Math				
Science (4)	Biology	Lab Science	Anatomy and Physiology	Science				
Social Studies (4)	World History and Geography I: Middle Ages	World History and Geography II: Modern World	U.S. History	U.S. Government (.5) and D.C. History (.5)				
Health (.5) and Physical Ed (1)	Health (.5) Physical Ed (.5)	Physical Ed (.5)						
World Languages (2)			World Language I	World Language II				
Art (.5)		Art (.5)						
Music (.5)		Music (.5)						
Elective / Major Courses	Principles of Information Technology	Computer Maintenance Technician I	Computer Maintenance Technician II	Practicum in Information Technology: Computer Maintenance Technician				
Total possible college credits completed in high school: XX					*Credit hours required to complete the AAS program: XX*			

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Course Standards

Principles of Information Technology

1. **General requirements.** This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. 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.

   B. 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.

   C. In Principles of Information Technology, students will develop computer literacy skills to adapt to emerging technologies used in the global marketplace. Students will implement personal and interpersonal skills to prepare for a rapidly evolving workplace environment. Students will enhance reading, writing, computing, communication, and reasoning skills and apply them to the information technology environment.

   D. Students will participate in at least two Career Exploration Work-Based Learning experiences in this course, which might include guest speakers and work-place tours relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. identify and demonstrate work behaviors and qualities that enhance employability and job advancement such as regular attendance, attention to proper attire, maintenance of a clean and safe work environment, pride in work, flexibility, and initiative;
      2. employ effective verbal and nonverbal communication skills;
      3. employ effective reading and writing skills;
      4. solve problems and think critically;
      5. demonstrate leadership skills and function effectively as a team member;
      6. identify and implement proper safety procedures; and
      7. demonstrate planning and time-management skills such as storyboarding and project management, including initiating, planning, executing, monitoring and controlling, and closing a project.

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B. **The student identifies various employment opportunities in the IT field. The student is expected to:**
   1. identify job opportunities and accompanying job duties and tasks;
   2. research careers of personal interest along with the education, job skills, and experience required to achieve personal career goals; and
   3. describe the functions of resumes and portfolios.

C. **The student uses evolving and emerging technologies to exchange information. The student is expected to:**
   1. identify and describe functions of various evolving and emerging technologies;
   2. send and receive text information and file attachments using electronic methods such as email, electronic bulletin boards, and instant message services;
   3. demonstrate effective Internet search strategies, including keywords and Boolean logic, using various available search engines;
   4. identify the various components of a Uniform Resource Locator;
   5. demonstrate ability to effectively test acquired information from the Internet for accuracy, relevance, and validity;
   6. explain issues concerning computer-based threats such as computer viruses, malware, and hacking; and
   7. explain issues concerning Internet safety such as identity theft, online predators, cyber-bullying, and phishing.

D. **The student demonstrates knowledge of the hardware components associated with information systems. The student is expected to:**
   1. identify major hardware components and their functions;
   2. use available reference tools as appropriate; and
   3. connect and use a variety of peripheral devices such as mouse, keyboard, microphone, digital camera, and printer.

E. **The student demonstrates knowledge of the different software associated with information systems. The student is expected to:**
   1. differentiate between systems and application software;
   2. identify and explain major operating system fundamentals and components such as disk operations, graphical user interface components, and hardware drivers;
   3. explain the purpose of file types across software products;
   4. demonstrate use of computer numbering systems and internal data representation such as identifying the hexadecimal value of a color;
   5. compare and contrast open source and proprietary software;
   6. explain use of system management tools;
   7. apply proper file management techniques such as creating, naming, organizing, copying, moving, and deleting files;
   8. use appropriate file protection and security; and
   9. explain the process for discovering, quarantining, and removing viruses from a computer system.

F. **The student analyzes network systems. The student is expected to:**
   1. identify hardware associated with telecommunications and data Computer Maintenance Technician such as servers, routers, switches, and network connectors;

2. identify and describe various types of networks such as peer-to-peer, local area networks, wide area networks, wireless, and Ethernet;
3. identify functions of network operating systems; and
4. explain troubleshooting techniques for various network connection issues.

G. **The student applies word-processing technology. The student is expected to:**
   1. identify the terminology associated with word-processing software;
   2. edit a variety of text documents using functions such as pagination, appropriate white space, tab settings, and font style, size, and color; and
   3. create professional documents such as memorandums, technical manuals, or proposals using advanced word-processing features.

H. **The student applies spreadsheet technology. The student is expected to:**
   1. identify the terminology associated with spreadsheet software;
   2. use numerical content to perform mathematical calculations;
   3. use student-created and preprogrammed functions to produce documents such as budget, payroll, statistical tables, and personal checkbook register;
   4. identify, generate, and describe the function of comma separated value files;
   5. create and analyze spreadsheets incorporating advanced features such as lookup tables, nested IF statements, subtotals, cell protection conditional formatting, charts, and graphs; and
   6. perform sorting, searching, and data filtering in documents.

I. **The student explores computer programming concepts. The student is expected to:**
   1. identify the function of compilers and interpreters;
   2. explain the difference between the operation of compilers and interpreters;
   3. identify various computer languages and how the languages are used in software development;
   4. recognize data representation in software development such as string, numeric, character, integer, and date;
   5. identify and explain the concept of algorithms; and
   6. describe the flow of a structured algorithm, including linear and iterative instructions such as using a flow chart.

J. **The student explores database technology. The student is expected to:**
   1. identify the terminology associated with database software and database functions;
   2. explore the application of databases;
   3. identify and explain the purpose and elements of a query language;
   4. identify and explain the purpose of fields and records; and
   5. describe the process of constructing a query, including multiple search parameters.

K. **The student applies presentation management technology. The student is expected to:**
   1. identify the terminology and functions of presentation software; and
   2. create, save, edit, and produce presentations incorporating advanced features such as links, hyperlinks, audio, and graphics.

L. **The student applies design and web publishing techniques. The student is expected to:**
1. identify the terminology associated with web page development and interactive media;
2. identify and explain design elements such as typeface, color, shape, texture, space, and form;
3. identify and explain design principles such as unity, harmony, balance, scale, and contrast;
4. identify and explain common elements of Hyper Text Markup Language (HTML) such as tags, stylesheets, and hyperlinks; and
5. create a web page containing links, graphics, and text using appropriate design principles.

M. **The student develops technology skills. The student is expected to:**
1. use technology as a tool to research, organize, evaluate, and communicate information.
2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/Computer Maintenance Technician tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy;
3. demonstrate using current and new technologies specific to the program of study, course; and/or industry; and
4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

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Networking I

1. **General requirements.** This course is recommended for students in Grades 10-12. Prerequisites: Principles of Information Technology.

2. **Introduction.**
   A. 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.

   B. 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.

   C. The Computer Maintenance Technician I course is normally comprised of the courses called Cisco CCNA R&S: Introduction to Networks (CCNA 1) and Cisco CCNA R&S: Routing and Switching Essentials (CCNA 2). The Introduction to Networks course introduces the concept of Computer Maintenance Technician, using various analogies to help the student understand the movement of packets throughout the Internet, and the protocol standards used. The Routing and Switching course moves the student into the theory of "moving packets." The concepts of routing and switching "packets" to the correct destination is covered, and how a network administrator can direct and/or streamline this process through device configuration and deployment.

   D. Students will participate in at least two Career Awareness Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills**
   A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
      1. 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;
      2. identify and demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, listening attentively to speakers, and willingness to learn new knowledge and skills;
      3. employ effective reading and writing skills;
      4. solve problems and think critically;
      5. demonstrate leadership skills and function effectively as a team member;
      6. identify and implement proper safety procedures;
      7. demonstrate an understanding of legal and ethical responsibilities in relation to the field of information technology; and
      8. demonstrate planning and time-management skills.

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B. **The student identifies various employment opportunities in the information technology field. The student is expected to:**
1. improve on a personal career plan along with education, job skills, and experience necessary to achieve career goals;
2. develop a resume and portfolio appropriate to chosen career plan, including letters of recommendation; and
3. illustrate interview skills for successful job placement.

C. **The student develops technology skills. The student is expected to:**
1. Use technology as a tool to research, organize, evaluate, and communicate information.
2. Use digital technologies (computers, PDAs, media players, GPSs, etc.), communication/Computer Maintenance Technician tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to successfully function in a knowledge economy.
3. Demonstrate utilizing current and new technologies specific to the program of study, course, and/or industry.
4. Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

D. **The student applies communication, mathematics, English language arts, and science knowledge and skills to research and develop projects. The student is expected to:**
1. demonstrate proper use of written, verbal, and visual communication techniques consistent with Computer Maintenance Technician industry standards;
2. demonstrate proper use of mathematics concepts in the development of Computer Maintenance Technician technologies; and
3. demonstrate proper use of science principles in the development of Computer Maintenance Technician technologies.

E. **The student understands the operation of data networks. The student is expected to:**
1. describe the purpose and functions of various network devices;
2. describe the components required for network and Internet communications;
3. select the correct components required to meet a given network specification;
4. describe the purpose and basic operation of the protocols in the Open Systems Interconnection (OSI) and Transmission Control Protocol (TCP) models and their associated protocols;
5. describe the impact of common Computer Maintenance Technician applications Voice Over Internet Protocol (VOIP) and Video Over IP (VIP) on a network;
6. interpret network diagrams;
7. predict the path between two hosts across a network; and
8. differentiate between Local Area Networks/Wide-Area Networks (LAN/WAN) operation and features.

F. **The student configures, verifies and troubleshoots switching. The student is expected to:**
1. select the appropriate media, cables, ports, and connectors to connect switches to other network devices and hosts;
2. explain the technology and media access control method for Ethernet technologies;
3. explain network segmentation and basic traffic management concepts;

4. explain the operation and concepts of basic switching;
5. perform, save and verify initial switch configuration including Switched Virtual Interfaces (SVI) and Default Gateway;
6. verify network status and switch operation using basic utilities;
7. implement and verify basic security for a switch;
8. identify, prescribe, and resolve common switched network media issues, configuration issues, auto negotiation, and switch hardware failures;
9. describe the function and operation of Virtual Local Area Networks (VLANs); and
10. configure, verify, and troubleshoot VLANs and trunking.

G. **The student implements Internet Protocol version 4 (IPv4) and Internet Protocol version 6 (IPv6) addressing schemes and services to meet network requirements. The student is expected to:**
1. describe the need and role of addressing in a network;
2. compare and contrast IPv4 and IPv6;
3. create and apply appropriate IP addressing schemes to a network;
4. assign and verify valid IP addresses to hosts, servers, and Computer Maintenance Technician devices in a LAN environment;
5. explain the basic uses and operation of Network Address Translation (NAT) in IPv4;
6. describe and verify Domain Name Service (DNS) operation;
7. describe the operation and benefits of using private and public IPv4 addressing;
8. implement static and dynamic addressing services for hosts in a LAN environment; and
9. identify and correct IP addressing issues.

H. **The student configures, verifies, and troubleshoots routing. The student is expected to:**
1. describe basic routing concepts;
2. describe the operation of routers;
3. compare and contrast methods of routing and routing protocols;
4. configure, verify, and troubleshoot routing protocols;
5. connect, configure, and verify operation status of a device interface;
6. verify device configuration and network connectivity using ping, traceroute, telnet, Secure Shell (SSH) or other utilities;
7. perform and verify routing configuration tasks for a static or default route given specific routing requirements;
8. manage Internetwork Operating System (IOS) and configuration files including save, edit, upgrade, backup, and restore;
9. implement password and physical security;
10. configure and verify interVLAN routing;
11. configure and verify Access Control Lists (ACLs);
12. configure and verify Domain Host Configuration Protocol (DHCP) and Network Address Translation (NAT); and
13. troubleshoot and correct network and configuration issues.

I. **The student develops technology skills. The student is expected to:**
   1. use technology as a tool to research, organize, evaluate, and communicate information.
   2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/Computer Maintenance Technician tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy;
   3. demonstrate using current and new technologies specific to the program of study, course; and/or industry; and
   4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Computer Maintenance

1. **General requirements.** This course is recommended for students in Grades 10-12. Prerequisite: Principles of Information Technology. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. 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.

   B. 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.

   C. In Computer Maintenance, students will acquire knowledge of computer maintenance and creating appropriate documentation. Students will analyze the social responsibility of business and industry regarding the significant issues relating to the environment, ethics, health, safety, and diversity in society and in the workplace as related to computer maintenance. Students will apply technical skills to address the IT industry and emerging technologies.

   D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which might include paid or unpaid internship experiences relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. employ effective reading and writing skills;
      2. employ effective verbal and nonverbal communication skills;
      3. solve problems and think critically;
      4. demonstrate leadership skills and function effectively as a team member;
      5. identify and implement proper safety procedures;
      6. demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and
      7. demonstrate planning and time-management skills such as project management, including initiating, planning, executing, monitoring and controlling, and closing a project.

   B. **The student identifies various employment opportunities in the IT field. The student is expected to:**
      1. identify job opportunities and accompanying job duties and tasks; and
      2. examine the role of certifications, resumes, and portfolios in the IT profession.

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C. **The student applies academic skills to the requirements of computer technologies. The student is expected to:**
   1. demonstrate effective verbal and written communication skills with individuals from varied cultures such as fellow workers, management, and customers; and
   2. interpret appropriate documentation such as schematics, drawings, charts, diagrams, technical manuals, and bulletins.

D. **The student acquires an understanding of computer hardware technologies. The student is expected to:**
   1. explain the fundamentals of microprocessor theory;
   2. define the use of Boolean and Binary logic in computer technologies;
   3. explain the theories of magnetism, electricity, and electronics as related to computer technologies;
   4. explain proper troubleshooting techniques as related to computer hardware;
   5. differentiate among digital and analog input and output electronics theory;
   6. explain the relationships relative to data-communications theory;
   7. describe the architecture of various computer systems;
   8. describe the function of computer components such as central processing units, storage devices, and peripheral devices;
   9. explain computer system environmental requirements and related control devices; and
   10. identify new and emerging technologies that may affect the field of computer technology.

E. **The student uses hardware design, operation, and maintenance knowledge and skills to identify major computer components. The student is expected to:**
   1. identify the purpose and function of computer components in the operation of the computer system such as central processing unit, mother board, sockets, chipsets, basic input and output system and their drivers, memory, hard drive technologies, video cards, input and output devices and ports, and modem and network interface cards (NIC);
   2. identify how mobile devices such as personal data assistants and cell phones operate;
   3. identify how mobile devices such as personal data assistants and cell phones connect and share data;
   4. demonstrate an understanding of the rationale behind error messages and symptoms of hardware failures;
   5. research interrupt sequences and beep codes; and
   6. identify priorities and interrupts at the system level.

F. **The student acquires knowledge of operating system design, including operation and maintenance. The student is expected to:**
   1. explain the fundamentals of an operating system;
   2. compare and contrast different operating systems; and
   3. identify the operating systems of mobile devices.

G. **The student acquires knowledge of the theory behind the installation, configuration of software programs, and updates in IT systems. The student is expected to:**
   1. identify the operational features and proper terminology related to computer software systems;
   2. evaluate application software packages;
   3. verify that software is properly licensed prior to installation;
   4. differentiate between types of software such as Software as a Service, single-user, per-seat, enterprise, freeware, shareware, and open-source licensing; and

5. explain proper troubleshooting techniques related to computer software.

H. **The student acquires knowledge of the installation and configuration of network connections. The student is expected to:**
    1. explain the fundamentals of network connections and interface requirements;
    2. explain the steps required to install and configure a computer on a network; and
    3. identify the steps to troubleshoot network connectivity.

I. **The student develops technology skills. The student is expected to:**
    1. use technology as a tool to research, organize, evaluate, and communicate information.
    2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/Computer Maintenance Technician tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy;
    3. demonstrate using current and new technologies specific to the program of study, course; and/or industry; and
    4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Practicum in Information Technology: Computer Maintenance Technician

1. **General requirements**. This course is recommended for students in Grade 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Information Technology Career Cluster. Prerequisite: Computer Maintenance. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. 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.

   B. 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.

   C. In the Computer Maintenance Technician Practicum, students will gain knowledge and skills in the area of computer technologies, including advanced knowledge of electrical and electronic theory, computer principles, and components related to the installation, diagnosis, service, and repair of computer-based technology systems. Students will reinforce, apply, and transfer their knowledge and skills to a variety of settings and problems. Proper use of analytical skills and application of IT concepts and standards are essential to prepare students for success in a technology-driven society. Critical thinking, IT experience, and product development may be conducted in a classroom setting with an instructor, with an industry mentor, or both.

   D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which includes paid or unpaid internship, pre-apprenticeship, or apprenticeship experiences relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills required by business and industry. The student is expected to:**
      1. identify and demonstrate 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;
      2. identify and demonstrate qualities such as flexibility, open-mindedness, initiative, listening attentively to speakers, and willingness to learn new knowledge and skills;
      3. employ effective reading and writing skills;
      4. employ effective verbal and nonverbal communication skills;
      5. solve problems and think critically;
      6. demonstrate leadership skills and function effectively as a team member;
      7. identify and implement proper safety procedures;
      8. demonstrate an understanding of legal and ethical responsibilities in relation to the field of IT; and

9. demonstrate planning and time-management skills such as storyboarding and project management, including initiating, planning, executing, monitoring and controlling, and closing a project.

B. **The student identifies various employment opportunities in the IT field. The student is expected to:**
1. improve on a personal career plan along with education, job skills, and experience necessary to achieve career goals;
2. develop a resume appropriate to a chosen career plan, including letters of recommendation; and
3. illustrate interview skills for successful job placement.

C. **The student relates core academic skills to the requirements of computer technologies. The student is expected to:**
1. demonstrate effective verbal and written communication skills with individuals from varied cultures such as fellow workers, management, and customers;
2. complete work orders and related paperwork for repair and installation;
3. estimate supplies, materials, and labor costs for installation, maintenance, and repair work orders; and
4. read and interpret technical documentation such as schematics, drawings, charts, diagrams, technical manuals, and bulletins.

D. **The student applies communication, mathematics, English, and science knowledge and skills to research and develop projects. The student is expected to:**
1. demonstrate proper use of written, verbal, and visual communication techniques consistent with IT industry standards;
2. demonstrate proper use of mathematics concepts in the development of products or services; and
3. demonstrate proper use of science principles to the development of products or services.

E. **The student knows the concepts and skills that form the basis of computer technologies. The student is expected to:**
1. explain microprocessor theory;
2. define the use of Boolean logic in computer technologies;
3. describe the theories of magnetism, electricity, and electronics as they apply to computer systems;
4. identify proper troubleshooting techniques;
5. differentiate among digital and analog input and output electronics theories;
6. describe the architecture of various computer systems;
7. describe the function of central processing units, storage devices, peripheral devices, and microprocessor units; and
8. explain computer system environmental requirements and related control devices.

F. **The student knows the proper function and application of the tools, equipment, technologies, and materials used in computer technologies. The student is expected to:**
1. demonstrate safe use of equipment in computer technologies such as hand and power tools;
2. employ available reference tools, materials, and Internet sources to access information as needed;
3. demonstrate the proper handling and disposal of environmentally hazardous materials used in computer technologies; and
4. identify new and emerging technologies that may affect the field of computer technology such as quantum computing, photonics, and nanotechnology.

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G. **The student applies the essential knowledge and skills for computer technologies to career preparation, job shadowing, mentoring, or apprenticeship training in simulated and actual work situations. The student is expected to:**
1. identify a problem relating to information technology;
2. develop a solution using appropriate technologies, IT concepts, and IT industry standards;
3. explain how the proposed technological solution will resolve the problem and the methodologies involved;
4. apply decision-making techniques to the selection of technological solutions;
5. identify areas where quality, reliability, and safety can be designed into a product or service;
6. apply critical-thinking strategies to analyze and evaluate the proposed technological solution;
7. develop a sustainability plan for the product or service;
8. select and use the appropriate technological resources to conduct, research, design, and develop activities;
9. develop the documentation of the research and development process; and
10. present the solution to a panel of professionals using formal presentation skills.

H. **The student employs project management knowledge to oversee IT projects. The student is expected to:**
1. implement project methodologies, including initiating, planning, executing, monitoring and controlling, and closing a project, to manage information system projects;
2. define the scope of work to achieve individual and group goals;
3. develop time and activity plans to achieve objectives;
4. implement or participate with cross-functional teams to achieve IT project goals;
5. develop and implement quality assurance test plans; and
6. create a contingency plan.

I. **The student recognizes and analyzes potential IT security threats to develop and maintain security requirements. The student is expected to:**
1. describe potential security threats to information systems;
2. identify the range of security needs and the problems that can occur due to security lapses;
3. develop and implement plans to address security threats;
4. document security procedures; and
5. describe the use of computer forensics in countering security threats such as IT crimes and security breaches.

J. **The student provides support to computer users to maintain service. The student is expected to:**
1. employ effective listening skills when working with clients to identify support needs;
2. identify customer need and formulate a support plan;
3. create queries and reports and assess critical system information;
4. employ problem-solving skills in performing support, maintenance, and repair;
5. use hardware and software diagnostics;
6. report to the user the cause of and solution to the problem; and
7. create written documentation indicating the cause of and solution to the problem.

K. **The student demonstrates and applies knowledge of security risks and safeguards. The student is expected to:**
1. install security software;
2. update security software; and
3. use security software to clean an infected machine.

L. **The student provides support to computer users to maintain service. The student is expected to:**
1. develop a written disaster recovery plan; and
2. develop a written preventive maintenance plan.

M. **The student creates a personal portfolio. The student is expected to:**
1. create a portfolio that documents all projects and accomplishments such as academics, volunteer experience, employment experience, awards, and certifications;
2. organize and prioritize information within the portfolio; and
3. use written, verbal, and visual communication techniques consistent with IT industry standards.

N. **The student develops technology skills. The student is expected to:**
1. use technology as a tool to research, organize, evaluate, and communicate information.
2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/Computer Maintenance Technician tools, and social networks appropriately to access, manage; integrate, evaluate, and create information to successfully function in a knowledge economy;
3. demonstrate using current and new technologies specific to the program of study, course; and/or industry; and
4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.