



INFORMATION TECHNOLOGY – TECHNOLOGIST (INFTY 2021)

Preamble

The Canadian Technology Standards (CTS) are a collection of learning outcomes for Canada's engineering technology and applied science profession at the technician and technologist level.

Stakeholders

The CTS may be utilized by accreditation bodies, provincial professional associations, educational institutions, government agencies, industry and others for the purposes accreditation, certification and other applications.

Educational Programs

The Information Technology CTS is relevant to programs including, but not limited to, computer programming, computer systems analysis, design and security, computer architecture and networks, database systems, internet, and intranet technologies at the at the technologist level.

Learning Outcomes

This CTS list Discipline Learning Outcomes (DLO) which describe the significant and essential learning that students have achieved and can reliably demonstrate at the time of graduation. Each DLO has a number of Learning Outcome Indicators (LOI), which are examples illustrating, defining and clarifying the level of performance expected. The list of LOI is not comprehensive and there may be other indicators which can be used to assess achievement of learning outcomes.

Graduate Capability

Students graduating from an accredited program have demonstrated achievement of all general learning outcomes, including a prescribed level of math, and discipline learning outcomes selected by the program.

Having completed a program that is based on applied mathematics and scientific and engineering theory, principles and practices and having acquired the knowledge, skills and attitudes to function in the work place, graduates are;

- able to evaluate assignments, establish objectives, set parameters and determine appropriate procedures and actions.
- able to exercise due diligence in the workplace and adhere to related practices, applicable laws and health and safety practices.
- able to work in accordance with labor-management principles and practices.
- able to work independently or interdependently as part of a discipline or multi-disciplinary team.
- prepared to assume responsibility for their work.

Graduate Career Opportunities

Graduates of Information Technology - Technologist programs have career opportunities in such areas as: business, industry, construction, government, health systems and public organizations. They may find employment in careers such as: design of systems and processes, infrastructure; maintenance of equipment or systems; interpretation or preparation of specifications, or instructions; quality management and inspection; project management and contract management; administration; systems analysis; manufacturing operations; field and customer service; estimating; technical sales; supervision of projects; and training activities.

Discipline Learning Outcomes (DLOs)

INFTY01 Computer Systems and Applications

- Analyze, implement, construct and maintain computer systems and applications.

Learning Outcome Indicators include:

- 1.1 Generate and explain system requirements for application.
- 1.2 Research business case using evaluation and feasibility studies, and preliminary investigation.
- 1.3 Evaluate strategy alternatives by developing in-house software, acquiring software, or outsourcing.
- 1.4 Implement formal design procedures utilizing variety of analysis, design, and development methods.
- 1.5 Apply Systems Development Life Cycle (SDLC).
- 1.6 Apply standard system management tools.
- 1.7 Apply standard system modelling tools.
- 1.8 Apply fundamentals of structured programming.
- 1.9 Create program classes and methods to help modular program code.
- 1.10 Apply iteration, recursion, and decision statements using common programming language.
- 1.11 Analyze, design, develop, and maintain effective user interfaces.
- 1.12 Demonstrate competency in programming.
- 1.13 Create, present, and maintain current, clear, and accurate documentation.

INFTY02 Quality Assurance Planning

- Configure, integrate, deploy, and install fully tested programs and prepare quality assurance plan for testing and evaluation of software.

Learning Outcome Indicators include:

- 2.1 Test and diagnose programs utilizing variety of techniques.
- 2.2 Select appropriate testing methods based on specifications and document results of tests.
- 2.3 Organize and develop integration testing.
- 2.4 Implement complete systems tests, including user acceptance tests.
- 2.5 Modify, integrate, and develop programs in different platforms.
- 2.6 Deploy programs minimizing risk to clients.

INFTY03 Project Management

- Apply advanced project management techniques.

Learning Outcome Indicators include:

- 3.1 Apply elements of project management and associated process methods.
- 3.2 Interpret relationship between various project activities and resulting interdependency.
- 3.3 Create project charter.
- 3.4 Justify importance of scope management to define successful completion of project.
- 3.5 Create work breakdown structure and schedules and monitor project schedules.
- 3.5.1 *Identify problems that will affect project schedules and revise schedules as necessary.*
- 3.6 Create performance reports to describe activity or milestone.
- 3.7 Breakdown and monitor multiple projects utilizing project management software.

INFTY04 Information Technology Systems

- Formulate information technology systems solutions and manage systems

Learning Outcome Indicators include:

- 4.1 Analyze and define problems.
- 4.2 Resolve problems by applying a systematic approach and a variety of troubleshooting techniques.
- 4.3 Resolve complex problems and design algorithms for such problems by developing problem solving skills.
- 4.4 Detect solutions for specific computing problems using search techniques.
- 4.5 Use a variety of diagnostic tools.
- 4.6 Select solutions that have low-impact on existing systems and minimize risk of recurrence.
- 4.7 Implement solutions timely and effectively.
- 4.8 Assess, monitor, and review effectiveness of solutions.
- 4.9 Document problems and solutions and communicate results with others.

INFTY05 Hardware and Operating Systems

- Analyze and maintain hardware and operating systems.

Learning Outcome Indicators include:

- 5.1 Diagnose microprocessor core logic and associated technologies.
- 5.2 Diagnose and configure primary and secondary storage technologies.
- 5.3 Diagnose and configure peripheral technologies.
- 5.4 Diagnose analyze, and manager operating system processes.
- 5.5 Diagnose, analyze, and manage operating system memory architectures.
- 5.6 Diagnose, analyze, and manage operating system input/output management.

- 5.7 Diagnose, and manage operating system file management strategies.
- 5.8 Diagnose, analyze, and manage file system security management strategies.
- 5.9 Diagnose, design, and deploy operating system script/batch programs.

INFTY06 Information Security

- Design and maintain security features involved with the processing and transfer of information.

Learning Outcome Indicators include:

- 6.1 Explain risk, threat, vulnerability, and safeguards as applied to information security.
- 6.2 Explain common sources of vulnerabilities in hardware, operating systems, protocols, and applications.
- 6.3 Identify known vulnerabilities using Common Vulnerabilities and Exposure (CVE) lists.
- 6.4 Explain concept of digital signatures and understand how they can be used to guarantee data integrity and provide non-repudiation.
- 6.5 Explain principles and practices of Public Key Infrastructure (PKI).
- 6.6 Explain concept of Public Key Infrastructure Certificates and the role trusted certificate authorities play in providing mutual authentication in web-based systems.
- 6.7 Explain common types of authentications systems such as biometric, token, and multifactor.
- 6.8 Identify and defend against common types of destructive devices such as viruses, Trojans, worms, and Spyware.
- 6.9 Explain common types of access control lists such as mandatory, role-base, and discretionary.
- 6.10 Recommend physical security measures to control access in typical networked environment.

INFTY07 Security in Networking and Applications Development

- Design and maintain systems security in networking and applications development.

Learning Outcome Indicators include:

- 7.1 Identify fundamental issues and solution avenues for network security.
- 7.2 Analyze and explain a variety of system threats and attack methodologies.
- 7.3 Explain principles and practices of user authentication and data encryption techniques.
- 7.4 Apply principles and practices of symmetric encryption techniques.
- 7.5 Apply principles and practices of wireless security protocols.
- 7.6 Apply principles and practices behind firewalls and proxies.
- 7.7 Apply principles and practices involving remote access services, RADIUS, VPNs, and other associated security configurations.
- 7.8 Explain principles behind intrusion detection, analysis, and prevention systems.

- 7.9 Create secure Windows and Linux client/server environments.
- 7.10 Evaluate network risk analysis survey and provide recommendations.

INFTY08 Protocols, Topologies, and Mobile Technologies

- Develop protocols, topologies, and mobile technologies.

Learning Outcome Indicators include:

- 8.1 Implement installation and administer client-side and server-side applications and services.
- 8.2 Diagnose, configure, and maintain DNS and DHCP.
- 8.3 Diagnose, analyze, configure, apply, deploy, and maintain TCP/IP protocols.
- 8.4 Analyze and apply the OSI model.
- 8.5 Diagnose, analyze, configure, deploy, maintain, and optimize OSI Layer 2-3 devices and associated protocols.

INFTY09 RDMS and OO-DBMS

- Design Relational Database Management Systems (RDMS) and Object-Oriented Database Management Systems (OO-DBMS).

Learning Outcome Indicators include:

- 9.1 Design relational database for applications using visual software tools.
- 9.2 Design user forms for applications using database data model.
- 9.3 Design and run reports for database applications.
- 9.4 Create advanced database queries such as joins, sub-queries, and unions.
- 9.5 Demonstrate how to select, create, and alter data from database using SQL.
- 9.6 Create database table normalization to at least 3rd normal form.
- 9.7 Apply entity-relationship model for conceptual data modelling of database application.
- 9.8 Reconstruct conceptual data model into logical database model using standard relational modelling techniques.
- 9.9 Analyze and implement database security procedures.
- 9.10 Apply use of database triggers to enhanced data integrity and security.

INFTY10 Systems Analysis and Design

- Analyze and design systems applying SAD fundamentals, UML, and software engineering.

Learning Outcome Indicators include:

- 10.1 Explain functions of Structured Analysis of the Systems Development Life Cycle (SDLC).

- 10.2 Explain importance, uses, and components of Computer Assisted Software Engineering (CASE).
- 10.3 Explain Unified Modeling Language (UML) and advantage of using CASE tools in developing Object Model.
- 10.4 Explain Data and Process Modeling using Data Flow Diagrams (DFD), Data Dictionaries, and Process Description Tools-Awareness of Logical vs. Physical Models.
- 10.5 Develop systems design input and output.

INFTY11 Object-Oriented Programming

- Analyze and design visual and non-visual approaches to Object-Oriented Programming.

Learning Outcome Indicators include:

- 11.1 Develop program logic using tools such as flow charts, pseudo code, and IPO tables.
- 11.2 Test write, compile, and execute visual programs.
- 11.3 Create data structures to store and manipulate complex data types.
- 11.4 Apply and explain OOP classes and objects and object relationship diagrams.
- 11.5 Apply Object-Oriented Analysis with object modeling terms and concepts, including attributes, methods, messages, instances, inheritance, polymorphism, interfaces, and packages.
- 11.6 Configure, deploy, and manage graphical user interface (GUI) and command line interface (CLI) operating system.
 - 11.6.1 *Develop CLI and GUI based programs for both Windows and UNIX/Linux operating systems.*
- 11.7 Construct visual interfaces using visual programming language.
- 11.8 Analyze concept of memory management.
- 11.9 Perform algorithm development using common programming language.

INFTY12 Programming Languages

- Utilize all non-OOP, 3GLs, and 2GLs, excluding scripting languages.

Learning Outcome Indicators include:

- 12.1 Evaluate application of common interpretative and compiled languages.
- 12.2 Evaluate application of common procedural and object-oriented programming languages.
- 12.3 Analyze roles, strengths and weaknesses of common scripting languages.
- 12.4 Create and maintain vendor software development tool kits.
- 12.5 Plan and organize techniques for data exchange, such as object linking and embedding (OLE), dynamic data exchange and Extensible Mark-up Language (XML).

INFTY13 Network Systems

- Manage network systems.

Learning Outcome Indicators include:

- 13.1 Diagnose, analyze design, deploy, and maintain wireless networks.
- 13.2 Diagnose, configure, and administer LAN and WAN networks.
- 13.3 Design and deploy network backup and recovery operations.
- 13.4 Manage SNMP devices, network management software, and packet analysis tools.
- 13.5 Diagnose, configure, deploy, and maintain account and domain security.

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