Autonomous Systems Technician Diploma - AUST

Program Outline

PROGRAM IMPLEMENTATION DATE:	**September 2020**
OUTLINE EFFECTIVE DATE:	**September 2020**
PROGRAM OUTLINE REVIEW DATE:	**March 2025**

GENERAL PROGRAM DESCRIPTION:

Autonomous Systems Technicians for the mining and resources sectors are trained to install, maintain and repair wired and wireless communications equipment related to autonomous heavy vehicles and the sensor networks used in surface mines both in BC and in the Alberta oil sands. The program is designed also to support comparable skill requirements for similar Industrial Internet of Things (IIOT) and automation systems applications in natural resources and other sectors.

In year one, students learn the foundational skills required for more complex practical applications introduced later in the program. This includes a focus on electrical and electronics systems (AC, DC, circuits, and digital fundamentals). They then proceed to Microcontroller principles and several levels of data networks (LANs, WANs, routers, switches) and allowing networks to scale.

In year two, the program includes radio frequency concepts and practical applications for wireless environments as well as Microwave communications. Radio Frequency navigation and location tools and structured cabling systems are covered, culminating in applying the learned principles by configuring and testing real world systems, finding faults and advanced troubleshooting skills.

The Autonomous Systems Technician program Diploma is awarded to students completing the 60 credits of this program.

Program Information: This 2-year full-time program provides the knowledge, skills, and training required to prepare students for a career as an Autonomous Systems Technician.

Delivery: This program is delivered face to face.

COTR Credits: 60

Hours for this program: 2130 hours

Year 1

Typical Structure of Instructional Hours:

Instructional Activity	Duration
Lecture Hours	555
Seminars / Tutorials	
Laboratory / Studio Hours	555
Practicum / Field Experience Hours	
Other Contact Hours	
Total	1110

Practicum Hours (if applicable):

Type of Practicum	Duration
On-the-job Experience	N/A
Formal Work Experience	N/A
Other	N/A
Total	

Year 2

Typical Structure of Instructional Hours:

Instructional Activity	Duration
Lecture Hours	510
Seminars / Tutorials	
Laboratory / Studio Hours	510
Practicum / Field Experience Hours	
Other Contact Hours	
Total	1020

Practicum Hours (if applicable):

Type of Practicum	Duration
On-the-job Experience	N/A
Formal Work Experience	N/A
Other	N/A
Total	

Program Outline Author or Contact:
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Signature

APPROVAL SIGNATURES:

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Dean Signature

EDCO

Valid from: September 2020 – March 2025

Education Council Approval Date

PROGRAM PREREQUISITES AND TRANSFER CREDIT:

Admission Requirements:

- English Studies 12 or First Peoples English ; English 12 (60%) or equivalent
- 60% or higher in Foundations of Mathematics 11, Pre-Calculus 11, or Computer Science 11 or equivalent.

Highly Recommended:

- Physics 11 or equivalent

For students for whom English is a second language, students must meet the Grade 12 English equivalency level posted on the College Admissions and Registration website.

Progression: Students are required to maintain a minimum 60% average in each term with a minimum mark of 55% in each course to continue to the next term. The program average of 60% is required to receive the Autonomous Systems Technician program diploma.

Flexible Assessment (FA):

Credit can be awarded for this course through FA ☑ Yes ☐ No

Learners may request formal recognition for flexible assessment at the College of the Rockies through one or more of the following processes: External Evaluation, Worksite Assessment, Demonstration, Standardized Test, Self-assessment, Interview, Products/Portfolio, Challenge Exam. Contact an Education Advisor for more information.

Transfer Credit: For transfer information within British Columbia, Alberta and other institutions, please visit http://www.cotr.bc.ca/Transfer.

The College will engage with other BC Institutions offering related programming with the goal of creating reciprocal transfer options for students.

Autonomous Systems Technician Program
Program Design

Course	Credits	Hours Lecture / Lab
AUST 101 Technical Skills	3	60/60
AUST 102 DC Fundamentals	4	90/90
AUST 103 AC Fundamentals	4	75/75
AUST 104 Electronic Circuits 1	3	60/60
AUST 105 Electronic Circuits 2	3	45/45
AUST 106 Digital Fundamentals	3	60/60
AUST 107 Data Networks 1	3	45/45
AUST 108 Data Networks 2	3	45/45
AUST 109 Microcontroller Principles	4	75/75
AUST 201 Radio Frequency (RF) Principles 1	4	75/75
AUST 202 Radio Frequency (RF) Principles 2	3	60/60
AUST 203 Radio Frequency (RF) Transmission Lines and Antennas	3	45/45
AUST 204 Radio Frequency (RF) Navigation &Location*	3	45/45
AUST 205 Professional Skills	2	30/30
AUST 206 Microwave Communications	2	30/30
AUST 207 Structured Cabling Systems	3	45/45
AUST 208 Data Networks 3	3	45/45
AUST 209 Data Networks 4	3	45/45
AUST 210 Radio Frequency (RF) Applications*	4	90/90

Course Totals: Fall & Winter Semesters	**60**	**2130**

*needs development

Program Matrix
Year 1

Fall Term: 15 weeks **Term 1**
AUST 101 Technical Skills
AUST 102 DC Fundamentals
AUST 103 AC Fundamentals

Winter Term: 22 weeks **Term 2**
AUST 104 Electronic Circuits 1
AUST 105 Electronic Circuits 2
AUST 106 Digital Fundamentals
AUST 107 Data Networks 1
AUST 108 Data Networks 2
AUST 109 Microcontroller Principles

Year 2

Fall Term: 15 weeks **Term 3**
AUST 201 Radio Frequency (RF) Principles 1
AUST 202 Radio Frequency (RF) Principles 2
AUST 203 Radio Frequency (RF) Transmission Lines and Antennas
AUST 204 Radio Frequency (RF) Navigation &Location
AUST 205 Professional Skills

Winter Term: 18 weeks **Term 4**
AUST 206 Microwave Communications
AUST 207 Structured Cabling Systems
AUST 205 Professional Skills
AUST 208 Data Networks 3
AUST 209 Data Networks 4
AUST 210 Radio Frequency (RF) Applications

COURSE GRADE:

Course grades are assigned as follows:

Grade	A+	A	A-	B+	B	B-	C+	C	C-	D	F
Mark (Percent)	≥ 90	89-85	84-80	79-76	75-72	71-68	67-64	63-60	59-55		< 55

COURSE DESCRIPTIONS:

AUST 101 Technical Skills
This course provides the required skills for the student to perform the tasks that will be encountered in the practical phases of the Telecommunication Systems Technician Program. Theoretical concepts as well as practical applications are included. Safety concerns for the electronics industry including Workplace Hazardous Material Information System (WHMIS) requirements are addressed. Training will be provided in the use of small hand tools used in the telecommunications industry concluding with the construction of a small electronics project. Math skills used by a technician will be studied in this course focusing on the trigonometric functions and logarithmic functions which apply in communications systems. Training will be given in basic report writing including graphing as related to electronics.

AUST 102 DC Fundamentals
This course provides the foundation required for the understanding of all electronic circuits, including basic electrical principles and components. The concepts of the basic quantities of charge, voltage, current, resistance, energy and power are developed. The student will use Ohm's law, Kirchhoff's Voltage law and Kirchhoff's Current law to analyze series, parallel and series-parallel Direct Current (DC) circuits. Additional analysis tools such as Theremin's theorem and maximum power transfer are also covered. DC test equipment will be used for measurements. General troubleshooting strategies and techniques are introduced, with emphasis on methods used to isolate faults in an efficient and logical manner. Students will apply these principles to troubleshoot problems in series, parallel and series-parallel DC circuits. Electromagnetism is also introduced. Theory is reinforced with hands-on practice.

AUST 103 AC Fundamentals
This course provides the foundation required for the understanding of all electronic circuits with Alternating Current (AC) sources. The characteristics of various AC waveforms are discussed and measured. The concepts and calculations of reactive values are emphasized. The student will study the response to AC of various circuit configurations and apply this knowledge to the analysis of Resistor Capacitor (RC), RL, and RLC circuits. Various practical applications of circuit configurations are explored. Theory is reinforced with hands-on practice and exposure to troubleshooting techniques.

AUST 104 Electronic Circuits 1
This course is an introduction to semiconductor devices, including diodes, rectifiers, bipolar junction transistors, field effect transistors, solid state switching devices and photosensitive devices. Theory of operations for these devices is studied. Applications of semiconductors as switches and amplifiers are explored. Students will build circuits, test and measure operating parameters, and utilize troubleshoot techniques to problem solve circuits. They will also learn to relate schematic diagrams to their physical circuit counterparts. Theory is reinforced with hands on practice in this course. **Prerequisites:** AUST 103

AUST 105 Electronic Circuits 2
This course provides the theoretical and practical knowledge necessary for the student to install, maintain, and troubleshoot circuits which employ integrated semiconductor devices. The electronic devices covered are operational amplifiers, timers and voltage regulators. Practical circuits which employ these devices are also studied. Further training in soldering techniques for circuit boards is studied, including insertion and soldering of components, cleaning of soldered components and correct removal of soldered components. Theory is reinforced with hands on practice.

AUST 106 Digital Fundamentals
This course provides the theoretical and practical knowledge necessary for the student to install, maintain, and trouble-shoot circuits that contain digital logic devices. The Binary, Hexadecimal, and Decimal number systems are described, and techniques for converting from one system to another are introduced. Basic definitions and common elements of digital logic devices are introduced and explored. The digital logic devices covered include basic logic gates (AND, OR, NOR, NAND, XOR), logic functions, flip-flops, counters, shift registers, memories, and interfacing integrated circuits. Common representations of digital logic functions and circuits are introduced, including truth tables, waveform representations, schematics, symbols and Boolean expressions. Practical circuits that employ these devices are also studied. The lecture material is reinforced by a series of lab assignments that develop skills in designing and creating prototype circuits using common logic elements.

AUST 107 Data Networks 1
Instruction will cover the fundamentals of LANs, routers, switches, router and switch programming, network standards, and terminology. Topics also include the OSI model, cabling, TCP/IP protocol suite including IP addressing and sub netting for both IPv4 and IPv6. A close look at Ethernet and the functionality of the Data-Link and Physical layers allows students to visualize and describe communication between computers and networks. Students will also learn valuable network troubleshooting techniques and concepts.

AUST 108 Data Networks 2
This course provides insight into the architecture, components, and operations of routers and Ethernet switches in a small routed network. Students learn how to configure routers and switches for more advanced functions. Topics include static and dynamic routing, virtual LANs (VLAN), virtual trunking, inter-VLAN routing, Network Address Translation (NAT), Dynamic Host Configuration Protocol (DHCP), port security, standard access control lists, and device discovery protocols. Students work with both IPv4 and IPv6 addressing and sub netting.

AUST 109 Microcontroller Principles
Through the use of illustrative projects the student will explore the programming and operation of the PIC series of microcontrollers. The course will include lectures on Flow code software with exercises and laboratory experiments to reinforce the lecture material. General microcomputer architecture and hardware specific to the PIC series of microcontrollers is discussed and explored. The research, design, and construction of a student led project will form a portion of the final mark.

AUST 201 Radio Frequency (RF) Principles 1
This course is designed to introduce students to the concepts of electronics that are related to the transmission and reception of radio frequency (RF) signals. The course commences with a review of relevant basic electronic circuits including filters, amplifiers and oscillators, reinforced with selected laboratory experiments. Wireless communication fundamentals such as the frequency spectrum, noise, RF transmission spectral characteristics, channel bandwidth, and modulation/demodulation technologies will be covered. Information transmission in analog and digital forms is discussed. Frequency synthesizers and phase locked loop (PLL) circuits are also introduced.

AUST 202 Radio Frequency (RF) Principles 2
This course introduces the student to the theoretical and operational analysis of Angle Modulation (FM & PM) schemes as applied to radio transmission and reception. Common FM transmitter and receiver configurations, technical specifications, and schematics are investigated. Students will receive hands-on experience with basic analog and digital FM modulation technology. Commercial FM radio transmissions are examined and students are introduced to advanced digital modulation techniques. The basic theory of spread spectrum radio systems and DSP analog is introduced. Laboratory exercises include programming and performance testing of commercial LMR radios. Basic concepts of LMR dispatching is introduced to the student.

AUST 203 Radio Frequency (RF) Transmission Lines and Antennas
This course investigates Radio Frequency (RF) signal propagation in cables and through free space. Concepts related to transmission of the RF signal within cables and causes of transmission impairment are explored. Free space propagation of an RF signal as an Electromagnetic (E/M) field is examined. The properties of RF signals radiated by an antenna system will be explored. RF filtering systems are introduced, including cavity filters. The practical component of this course will include forward and reflected power measurements, Voltage Standing Wave Ratio (VSWR) minimization and Time Domain Reflectometry (TDR) fault location techniques for transmission line systems. Antenna operational parameters will be measured and cavity filter alignment will be performed.

AUST 204 Radio Frequency (RF) Navigation & Location*
This course examines the basic land and marine navigation systems in use today. Navigation principles and navigational terms will be covered. Global Positioning System (GPS) and associated technologies will be studied in-depth. Tracking and location systems such as Automatic Vehicle Location (AVL) will be investigated.

AUST 205 Professional Skills
This course will provide students with the skills to prepare for the workplace. The course will initially focus on cover letters, resumes, job interview techniques and presentation skills. Workplace appearance, communications, conduct, ethics, and safety will be examined. Training in effective customer relations and conflict resolution will be provided. The fundamentals of teams and supervisory skills in the areas of motivation, leadership, and training are introduced.

AUST 206 Microwave Communications
This course introduces the student to fundamentals of waveguide and microwave device theory. Health hazards and safe working/testing conditions are stressed at the start. The course explores the principles of Point-to Point land microwave fade margins and link budgets. Satellite communications and various orbits are covered. Common navigation/tracking satellite families are discussed. Fundamentals of radar are covered with a focus on pulsed radar system basics. Advanced systems such as phased array and marine radar are also introduced.

AUST 207 Structured Cabling Systems
This course will introduce students to copper and fiber optic structured cable systems. The course aims to offer a balanced mix of theory and practice relating to the current structured cabling system standards outlined by ANSI//TIA, ISO and other standards organizations. Students will learn proper installation and testing procedures for various copper category cabling in a complete structured cabling system. The fiber portion of the course will cover the basic concepts of light transmission theory in fiber, the different types of single-mode and multi-mode fibers, installation of various fiber optic connectors and fusion splicing of fibers. A high degree of importance will be placed on development of good hand skills and safely handling copper and fiber optic cabling.

AUST 208 Data Networks 3
This course introduces technologies that allow networks to scale, it describes the architecture, components, and operations of routers and switches in a large and complex networks. A review of switching technologies including VLANs, and inter-VLAN routing provides the foundation to explore spanning-tree and link-aggregation. A review of IPv4 and IPv6 routing fundamentals provides the foundation to explore Enhanced Interior Gateway Routing (EIGRP) and Open Shortest Path First (OSPF) routing protocols. By the end of this course, students will be able to configure and troubleshoot routers and switches and resolve common issues with OSPF, EIGRP, STP, and VTP in both IPv4 and IPv6 Networks. Included is a review of managing IOS images, configuration files and licensing.

AUST 209 Data Networks 4
This course introduces and extends the student's knowledge and practical experience with Wide Area Networks (WANs) and support for computer networks in remote office locations. Topics include WAN protocols for serial links, Multi-Protocol Label Switching (MPLS), Ethernet WAN, cable, Digital Subscriber Line (dsl), basic network security concepts and configuration, working with access controls lists, fundamentals of Virtual Private Networks (VPNs), and general troubleshooting. Students will develop the skills to interconnect networks which includes configuration and troubleshooting of branch office connections including quality of service, monitoring, and security. The content of Data Networks 3 and 4 prepares the students to write the Cisco CCNA Route Switch certification exam.

AUST 210 Radio Frequency (RF) Applications*
This course focuses on the configuration and testing of real world radio systems. Digital radio systems using both conventional and trunked mode operation will be configured, modified, tested and documented. IP Switching and Routing protocols will be used to configure wireless applications such as Radio over IP (RoIP), Wireless LANs and Point to Point communications systems. Advanced antenna systems will be built and tested and radio site power systems will be introduced. Students will learn the correct usage of technical manuals and radio system documentation. Advanced troubleshooting methodologies using logical fault finding are explored in the lab. Additional training in industry specific hand skills related to radio systems installation will be provided. General safety practices specifically related to the RF industry will also be reviewed.

*needs development