

Certification Exam Handbook Instrumentation Engineering Technology

Offered by:



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THE ASSOCIATION OF SCIENCE
AND ENGINEERING TECHNOLOGY
PROFESSIONALS OF ALBERTA

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Introduction

The **Instrumentation Technologist Certification Exam Handbook** has been prepared for instrumentation engineering technologists who are required to pass a certification exam to achieve registration within their respected technology associations. The handbook is designed to provide candidates with essential information regarding the certification examination.

Examination Information

Purpose of Examination

The purpose of the Instrumentation Technologist Certification Examination is to identify competent instrumentation engineering technologists who possess technical competencies in their discipline, as outlined in a discipline-specific competency profile. The goal is to protect the public by granting designations only to those professionals who have the skill and knowledge necessary to perform their job in a safe and competent manner.

Examination Format

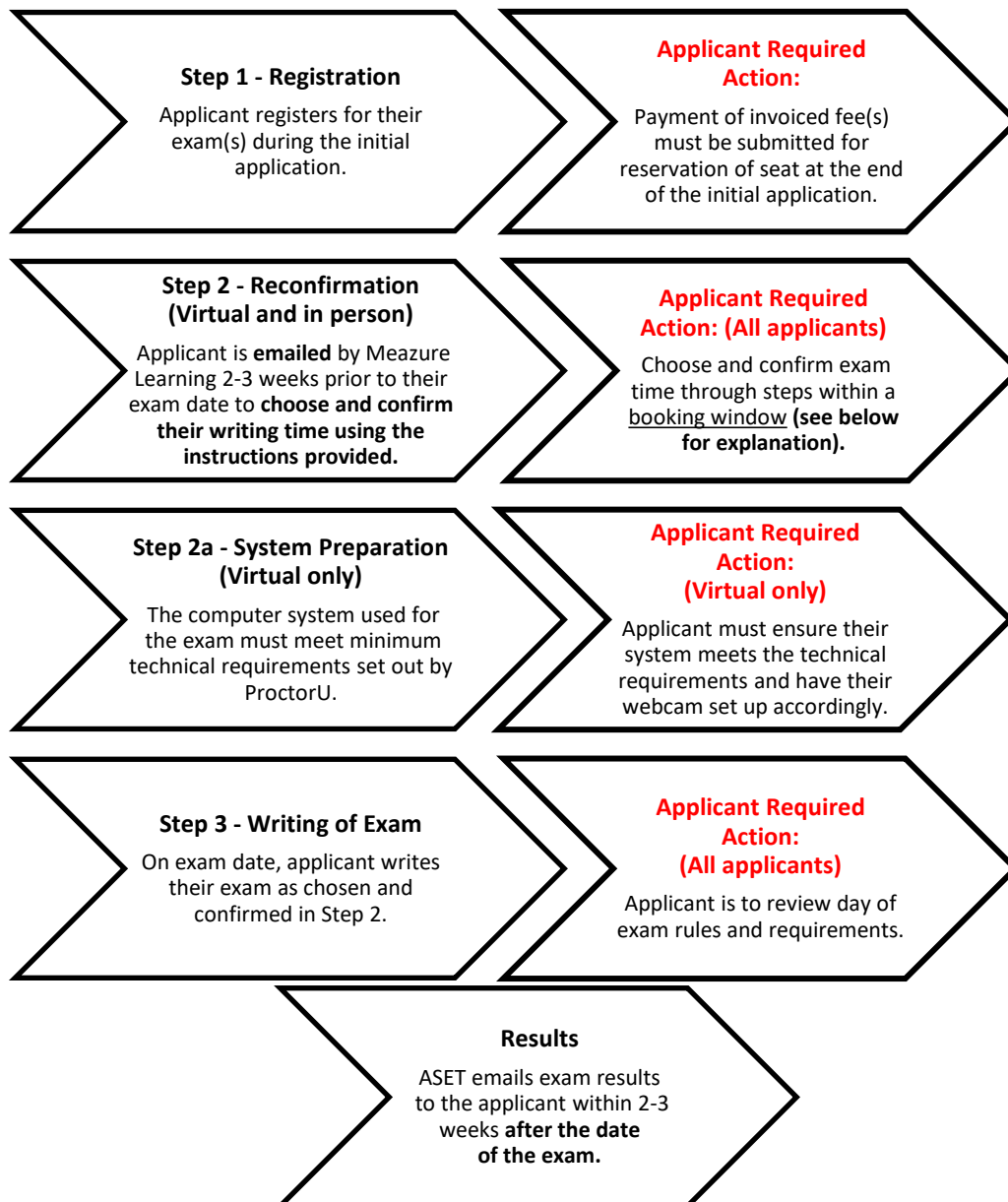
The examination consists of 110 multiple-choice questions, including questions with graphs, diagrams, and schematics and questions that require calculations. There are 10 experimental questions of the 110 that are not counted towards the candidate's exam score. These items are used for future exam development following the Embedded Field Testing Method. Each multiple-choice question has four answer options, only one of which is correct. Exam questions vary in the level of cognitive difficulty. The exam is closed-book and is three hours in duration.

Eligibility

To be eligible to write the exam, candidates must have obtained the minimum required technologist level experience to apply for their desired designation within their technology association. For this reason, student and T.T. members may not register to write the exam.

Examination Registration

Applicants who are required to complete the Instrumentation Technologist Certification Examination will register for the examination at the time of application. Please see the ASET, CTTAM, or ASTTBC websites for current information on examination dates and deadlines.



Booking Window

Two to three weeks prior to the exam, you will receive a booking email from Meazure Learning. This email will include the instructions on how to book a seat for your exam. We recommend watching this [quick video demonstration](#) on how to reserve your seat. Please note that these instructions are for the Virtual Booking; however, it is the same process if you are scheduled to write the exam at a brick-and-mortar (physical) location.

Location of Examination Centres and Virtual Proctoring

The Instrumentation Technologist Certification Exam is administered on a computer in one of Measure Learning's exam centres or through the virtual proctoring service.

Physical locations in Alberta include Edmonton, Calgary, Grande Prairie*, and Lethbridge*. Please contact ASTTBC or CTTAM for information on testing centres in British Columbia and Manitoba. **limited seating*

Virtual proctoring: This method of exam delivery uses a webcam with a virtual proctor to allow the candidate to write the exam from home. Work computers and networks are **no longer** permitted as there has been a significant increase in exam candidate technical issues (due to firewalls and restrictions on installing the necessary software to take the exam). To write the exam virtually, it is mandatory to use a personal device and network. This method also has the following additional requirements:

Exam room requirements

- Quiet and private room; **if anyone enters the room during the exam other than the above the candidate, the exam results may be invalidated**
- Good quality lighting in the room; no bright lights or windows behind candidate
- Desk must be clear of any notes, books, or electronics with access to power outlets and internet connection (Ethernet plugged or high-quality password protected Wi-Fi)

Internet requirements

- A hardwired connection is preferred (wireless permitted but not encouraged)
- Internet speed must be a minimum of 10Mbps.
- Browser's pop-up blocker must be disabled (ensure this is done by following this help [link](#))
- Test internet speed using any of the following tests:
 - <http://speedtest.googlefiber.net/>
 - <http://beta.speedtest.net/>
 - <https://fast.com>

Computer requirements

- Laptops or desktop computers are permitted so long as they have the following minimum requirements:
 - <https://support.proctoru.com/hc/en-us/articles/115011772748-Equipment-Requirements>
 - PC users must have Windows 10 to align with the operating system Microsoft is supporting
 - No virtual machine desktops (must be on the host desktop), or tablets or smartphones
 - Candidates must source their own computers with the minimum specifications for the exam
 - Google Chrome **required** (can use Firefox, Safari, but Chrome is highly recommended)
 - Laptops must be plugged in during the exam to prevent the exam terminating early due to battery failure
- Functioning free standing or integrated webcam with microphone or independent microphone
- Only one computer monitor allowed

Guardian Secure Proctoring Browser requirements

- Candidates must download the Guardian Secure Proctoring Browser ahead of exam.
 - [Windows Download](#)
 - [Mac \(Intel\) Download](#)
 - [Mac \(M1\) Download](#)
 - To determine which Apple download to use, refer to this [support article](#).
- Google Chrome is highly recommended to download the browser

NOTE: It is the candidate's responsibility to ensure that the internet and computer requirements are met prior to the exam administration date. The **compatibility check** information will be located in your BOOKING CONFIRMATION email which is sent by Meazure Learning.

- **Applicants must conduct a compatibility check using the computer they will use, in the room they will write in to test their connectivity prior to the virtually proctored exam. If they do not complete the compatibility check, there is no guarantee that the exam will happen. The ProctorU exam program cannot be downloaded until the day of your exam so there is no way to check if it will work prior to exam day.**
- Meazure Learning has an [FAQ page](#) with a short tutorial video on the ProctorU program.

Exam Time and Confirmation

Virtual proctoring

Applicants can expect an email from Meazure Learning one **(1) to two (2) weeks** prior to their registered exam date with instructions to confirm their seat within a specified timeframe. The expected date of this email is the start of the "booking window" found [here](#). If the email cannot be located (check junk mail), please email testingsupport@meazurelearning.com to request that an exam grant email be resent, as ASET does not have access to this information.

Applicants who do not reconfirm their seat by the last day of the specific booking window (see [here](#)) will be unable to write the exam. As late confirmations are not possible, applicants are required to pay the full exam fee again to register for a new date. For this, please contact ASET at exams@aset.ab.ca.

In person

Applicants who writing at a physical testing centre location can expect an email from Meazure Learning **one (1) to two (2) weeks** prior to their registered exam date with the location and time details. The expected date of this email is the start of the "booking window" found [here](#). If by one (1) week before the exam date, the email cannot be located (check junk mail), please email testingsupport@meazurelearning.com to request that an exam grant email be resent, as ASET does not have access to this information.

As the physical location option **does not** require reconfirmation by applicants, the rescheduling policy below applies if applicants wish to reschedule to a new date or do not attend the exam. For this, please contact ASET at exams@aset.ab.ca.

Policy for Reschedules, Rewrites, and Attempts

Alberta Candidates

Candidates who wish to reschedule their exam must email the ASET Registration Department (exams@aset.ab.ca) with the new exam date. Candidates who reschedule **after the registered exam's Registration Deadline Date** are required to pay **the full exam fee** to

reschedule. If the request is received **before** this deadline date, then there are no fees to reschedule.

Candidates who are required to re-write the examination must email the ASET Registration Department (exams@aset.ab.ca) with the requested exam date. ASET Staff will follow up to obtain payment of the full exam fee in order to register for the requested date.

Candidates may attempt the exam **a maximum of three times** within one year from the date of application and must pass the exam within this time period.

British Columbia and Manitoba Candidates

Please contact ASTTBC or CTTAM directly to confirm the policy for reschedules, rewrites, and exam attempts.

Exam Accommodations for Candidates with Disabilities

According to Canadian human rights legislation and test industry standards, exam developers are responsible for providing candidates with disabilities with exam accommodations where appropriate and feasible. Exam accommodations are designed to remove barriers related to individual characteristics of candidates that may prevent them from demonstrating their technical competencies on the exam. “An appropriate accommodation is one that that responds to specific individual characteristics but does so in a way that does not change the construct the test is measuring or the meaning of scores.”¹

Candidates with disabilities should request accommodations to write the certification exam at the time of application and at least **seven (7) weeks before the exam date of their choice by submitting a request in writing to the ASET, ASTTBC, or CTTAM**. To protect the integrity of the examination, documented evidence of the candidate’s disability must be submitted to ASET, CTTAM, or ASTTBC along with the application form. Such evidence includes a formal detailed diagnosis of the specific disability from an appropriate professional (e.g., physician, psychologist, rehabilitation counsellor) and supporting documentation citing the need for exam accommodations and what accommodations the candidate received in the past.

ASET, CTTAM, or ASTTBC will review the candidate’s written request for accommodation and determine if it can be supported. Depending on the candidate’s individual needs, ASET, CTTAM, or ASTTBC may modify exam administration conditions, including exam setting, exam presentation, or the addition of individuals to the exam (e.g., readers, scribes). Each request will be reviewed on a case-by-case basis.

Below is a list of reasonable exam accommodations for candidates with a disability.*

1. *Separate Room*

A separate room is provided to candidates who due to the nature of their disability require an exam environment that minimizes distractions resulting from noise or movement or process information by talking aloud.

2. *Additional Time*

Extending additional time to candidates is a frequently used exam accommodation that is used with a variety of disability-related conditions. Often candidates are offered time-and-one-half to complete the exam (e.g., a 3-hour exam is extended to 4.5 hours).

3. *Interpreter*

Candidates with hearing impairment may request an interpreter who has proficiency in sign language.

4. *Reader*

A reader is an individual who reads exam instructions and/or exam questions to a candidate. Candidates with visual impairment or those with a learning disability may benefit from services of a reader during the examination.

5. *Recorder*

A recorder is an individual who fills in the answers for a candidate who has difficulty writing independently.

All costs related to exam accommodations will be the responsibility of the candidate.

¹ American Educational Research Association (2014). *Standards for Educational and Psychological Testing*. Washington, DC (p. 67)

Examination Content

The Instrumentation Technologist Certification Examination tests candidates' competencies in four areas (**see Appendix A for detailed information on examination content**).

- 1. Technical Analysis:** In this competency area, candidates are expected to be able to apply knowledge of instrumentation technology to the analysis of measurement, control, and automation of process applications.
- 2. Technical Design:** This competency area deals with candidates' ability to specify, design, and/or modify instrumentation for measurement, control, and automation of various process applications in accordance with technical specifications, client requirements, and applicable codes and regulations.
- 3. Technical Evaluation:** In this competency area candidates are expected to be able to install, calibrate, troubleshoot, maintain and evaluate the quality or performance of pneumatic, hydraulic, digital, electronic or microcomputer-based equipment in industrial and field environments in accordance with technical specifications, client requirements, and applicable codes and regulations.
- 4. Project Coordination:** This competency area deals with candidates' ability to assist in the management of projects to ensure high quality of deliverables, client satisfaction, and adherence to schedules and budgets.

Exam questions will also vary in cognitive level. *Knowledge* questions require that candidates recall information and provide its interpretation. *Application* questions require that candidates apply their knowledge to practical situations, while *Critical thinking* questions require that candidates analyze complex situations and provide solutions. There will also be a percentage of source based questions that may include an image, figure, tables, schematics, etc. **Refer to Appendix A for more detailed information.**

Study Resources for Examination

The following resources may be of use to candidates interested in refreshing their knowledge prior to writing the examination. **Candidates are not expected to study each of these resources as the certification exam is designed to test entry-level competencies related to the practice of instrumentation engineering technology.** Rather, candidates may wish to review particular content areas in which they feel they would like to update their current knowledge. For detailed information on the content areas covered on the exam, candidates should refer to **Appendix A**.

Bolton, W. (2015). Instrumentation and Control Systems. Elsevier Ltd.

Coggan, D. (2004). Fundamentals of Industrial Control: Practical Guides for Measurement and Control, 2nd Edition. International Society of Automation

Dunn, W. (2005). Fundamentals of Industrial Instrumentation and Process Control. McGraw-Hill

Fisher Valve Co. (2005). Control Valve Handbook, 4th Edition.

Frenzel Jr., L. (2008). Principles of Electronic Communication Systems, 3rd Edition. McGraw-Hill.

Liptak, B.G. (1995). Instrument Engineers Handbook, 4th Edition. CRC Press.

National Occupational Analysis (NOA). (2013). Instrumentation and Control Technician.
http://www.red-seal.ca/trades/instrumentctrltech/2013n.4.1_4v.2rv.3.2w-eng.html

Paynter B & Boydell T. (2009) Electronics Technology Fundamentals: Conventional Flow Version, 3rd Edition. Pearson Education Inc.

Tippens, P.E. (2007). Physics, 7th Edition. McGraw-Hill.

Wade, H. (2017). Basic and Advanced Regulatory Control, 3rd Edition. International Society of Automation.

Washington, A.J. (2014). Basic Technical Mathematics with Calculus, 10th Edition. Pearson Education Inc.

Whitt, M. (2012). Successful Instrumentation and Control Systems Design. International Society of Automation.

Practice Exam for Purchase

Practice exam questions are available for purchase through [Meazure Learning](#). As these questions are hosted by a third-party educational partner, candidates will need to create a new account to access the practice exam. This login is **not associated** with the candidate's ASET ID.

A one-time attempt practice exam of 25 questions* is available.

*While the candidate is able to repurchase the same practice exam at a later date; the questions will not change.

Day of Examination

Admission to the Examination Centre

ASET, CTTAM, and ASTTBC provide Meazure Learning with a list of examination candidates for each exam sitting. When an exam appointment is made, candidates will receive a booking confirmation email from Meazure Learning. **It is important that candidates bring this email with them to an examination center on the day of the examination.**

Upon entering the examination center, candidates will be asked to register with the proctor. The following information will need to be provided to the proctor.

- Candidate's first and last name (must match candidate's registration as submitted by ASET, CTTAM, or ASTTBC)
- Valid government-issued photo ID (not expired)
- Candidate's printed confirmation email as provided by Meazure Learning

Important Notes:

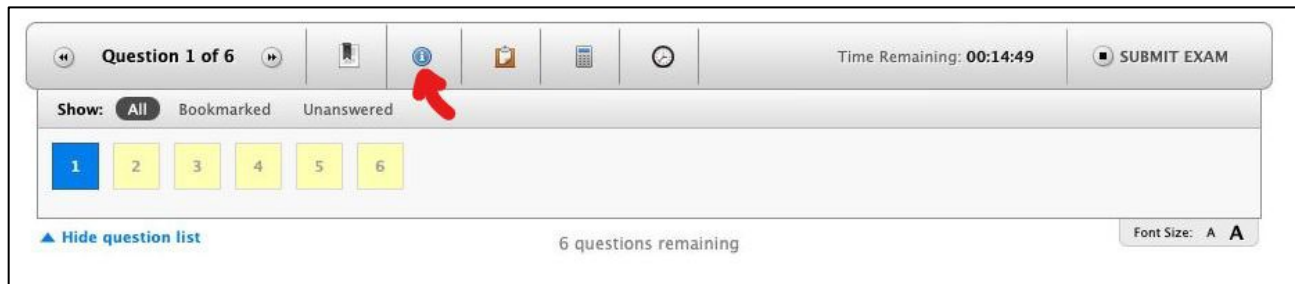
- If you have a non-expired temporary driver's license you must also provide another form of photo identification. The first and last name on both documents must match. It is preferred that the photo identification not be expired.
- If your only form of photo identification has expired you must also provide another form of non-expired identification. The first and last name on both documents must match.
- If you have any other concerns about your forms of identification, please contact Meazure Learning support immediately to ensure your identification will be accepted on exam day:
testingsupport@meazurelearning.com.

After the initial verification of identity, candidates will be asked to sign a roster.

Candidates' personal belongings, such as bags and jackets, will be stored in a designated area. Electronic devices, including but not limited to cell phones, tablets, and reference books, may not under any circumstances be brought into the exam center. The only exception to this rule is personal calculators. The proctor is responsible for inspecting candidate's calculators prior to the exam.

Permissible Items

- Disposable ear plugs (provided by candidate)
- Scrap paper and pencils will be provided by the proctor to the candidates before the exam (if requested) and collected after the exam
- Approved calculator (see policy below)
- Formula sheet is available virtually via the ProctorU Platform accessed via the blue “I” icon (refer to screenshot). **Note:** physical copies will not be permitted or available



Prohibited Items

- Electronic devices (i.e., cell phones, pagers, digital assistants etc.)
- All types of food and beverages
- Unauthorized examination aids, assistance or collaboration materials

Calculator Policy

- Candidates can bring in a Scientific Calculator that is non-programmable, non-graphing and have no memory storage capabilities.
- Please review the [Calculator Policy](#) prior to examination day. It contains a list of approved and non-approved calculator models
- It is highly recommended that the candidate bring their own calculator as the centre does not have any on site.
- It is the candidate's responsibility to ensure their calculator is approved prior to the exam, either by being indicated on the approved list or by obtaining approval from ASET, CTTAM, or ASTTBC. If a candidate does not obtain approval prior to the exam, their calculator may be deemed inadmissible and prohibited from the exam.

Taking the Exam

At the beginning of the examination, candidates will hear verbal examination instructions from the proctor and read the Candidate's Statement of Understanding and/or Non-disclosure Agreement in the software. Failure to comply with the regulations outlined in these documents will result in the candidate's results being invalidated. Candidates will not be able to begin the examination without agreeing to the conditions outlined in the document. The assigned ID and chosen password will be used to log in when prompted by the proctor.

Next, candidates will be given written exam instructions in the software. These exam instructions will emphasize the fact that some exam questions contain images and/or require calculations. If the images appear too small on the screen, candidates will be advised to hover their mouse over them to get an expanded view. Following the exam instructions, there will be

a tutorial available to candidates before they proceed to the exam.

The exam is closed-book and is three hours in duration. Once a candidate starts an exam they must complete the exam they started. If the candidate notices they have started the wrong examination, they must notify the proctor within the first 5 minutes of the exam sitting to switch to the correct exam.

Upon submitting their exam responses, candidates will be offered an opportunity to provide feedback on exam material and exam administration conditions by completing a short online survey. **Results of the exam are not provided to the candidates at this time.** Candidates will then submit their scrap paper to the proctor, sign out from the candidate roster, and leave the examination centre.

After the Examination

Examination Scoring

Multiple-choice examination questions are scored dichotomously, using a score of “0” for an incorrect response and a score of “1” for a correct response. The Technologist Certification Examinations are criterion-referenced exams, which means that a candidate should obtain a score that is equal or higher than an exam pass mark to pass the examination.

Pass Mark

Each Certification Examination has its own pass mark. The pass mark for the Instrumentation Technologist Certification Examination was determined by the Exam Committee, which took into account the difficulty of exam questions and the expected level of performance for a minimally competent engineering technologist. A psychometrically acceptable standard-setting methodology was used to set examination pass marks.

The pass mark for the Instrumentation Engineering Technologist Certification Exam is 68%.

Results

Candidates are emailed their exam results **within two to three weeks after the exam date.** Exam results are reported to the candidate as “pass” or “fail”.

Unsuccessful candidates will also receive a performance report indicating a failure to pass, their score, and areas of strength and weakness in the four tested competency areas. The unsuccessful candidates will be able to retake the exam. Please refer to the Rewrite Policy section in this handbook to schedule the next exam.

Review and Appeal Process

A candidate who fails the Certification Examination may request that their exam score be verified. Due to the automated scoring and extensive quality control procedures, errors in scoring are extremely unlikely. However, candidates may request that ASET, CTTAM, or ASTTBC manually rescore their exam to verify the original score.

Appendix A: Instrumentation Technologist Exam Blueprint

ASET Instrumentation Technologist Certification Examination Blueprint		
Competency	Multiple Choice Questions	
	Target Range (% of Qs)	Target Range (# of Qs)
1. Technical Analysis	30-40%	30-40
1.1 Explain the principles of operation and application of instruments for measurement of pressure, level, temperature, flow, weight, and density.		
1.2 Explain the principles and operation of analytical instruments for measurement of chemical composition, chemical detection, and vibration.		
1.3 Explain the principles and operation of final control elements, including control and on-off valves.		
1.4 Describe common control processes (e.g., temperature, pressure, flow, and level).		
1.5 Describe the difference between continuous and batch control processes.		
1.6 Describe different types of control strategies (e.g., cascade, ratio, split range, and low/high select).		
1.7 Describe the principles of proportional, integral, and derivative (PID) control and their effects on the control loop.		
1.8 Recognize situations with control loops that require tuning (e.g., feedback lag and dead band).		
1.9 Describe the effects of analog to digital and digital to analog conversion on the accuracy and resolution of measurement.		
1.10 Identify and describe basic control loop components.		
1.11 Assess issues with a basic feedback control loop (e.g., final control element performance, process disturbance, and set point change).		
1.12 Perform testing of control loops.		
1.13 Interpret control documentation (e.g., P&IDs, installation drawings, wiring diagrams, data sheets, shut-down key, logic drawings, and control-loop diagrams).		
1.14 Obtain technical data from vendors, equipment manuals, technical specifications, and standards.		
1.15 Examine historical data from instruments to validate measurements, diagnose issues, and/or determine corrective actions (e.g., asset management, alarm diagnostics, and frequency of data collection).		
1.16 Use calculations to validate instrument measurements (e.g., differential pressure level calculations, scaling signals for different ranges, number conversions from decimal to binary to hexadecimal).		
1.17 Verify instrument measurements against measurement standards		
1.18 Describe simple network topologies, devices, and access methods used in industrial communication protocols.		
1.19 Identify common types of communication protocols and their components (e.g., HART, Fieldbus, Modbus).		
1.20 Identify the principles of PLC and DCS operation.		
1.21 Distinguish between hydraulic and pneumatic controlled systems.		
1.22 Interpret flow diagrams in pneumatic and hydraulic systems.		
1.23 Explain the structure and operation of a safety instrumentation system (SIS).		
2. Technical Design	25-35%	25-35
2.1 Identify applicable codes and standards to follow in the design and selection of instrumentation (e.g., CSA, ISA, ANSI, Canadian Electrical Code, ABSA).		
2.2 Identify regulations related to measurement accuracy and traceability (e.g., ISO and ASTM).		

2.3 Size, specify and select appropriate control and on-off valves.		
2.4 Size, specify and select appropriate measurement instruments (e.g., flow, pressure, temperature, level).		
2.5 Distinguish between safety instrument systems (SIS) and non-SIS (e.g., safety integrity level (SIL), safety PLC, and safety instrument function).		
2.6 Describe the operation of basic series and parallel circuits (e.g., DC, AC).		
2.7 Select appropriate I/O hardware for a PLC and DCS control system.		
2.8 Develop a logic program for a DCS, RTU, or PLC.		
2.9 Develop a closed loop for process control.		
2.10 Develop simple control loops for process control (e.g., low select, on-off, and ratio control loops).		
2.11 Perform functional testing. (e.g., control loops, analytical instrumentation)		
2.12 Explain when and where isolators, shielding, and grounding are required.		
2.13 Assist in the development of procedures for calibration, loop function testing, logic testing and commissioning of instrumentation systems.		
2.14 Create or modify control system documentation, such as P&ID, instrument index, loop diagrams, data sheets, specification forms, and location plans		
2.15 Identify ways to reduce electromagnetic interference for instrumentation signals.		
2.16 Select proper material for instrumentation in accordance with process conditions and environment (e.g., NACE, ISA, CEC).		
3. Technical Evaluation	20-30%	20-30
3.1 Commission a controller for a basic control strategy. (e.g., on/off controller, proportional controller, PID controller)		
3.2 Troubleshoot various configurations in a basic control system.		
3.3 Troubleshoot digital (or smart) instruments using the appropriate communications protocol.		
3.4 Troubleshoot control systems (e.g., PLCs and DCS).		
3.5 Perform equipment inspection in an industrial environment.		
3.6 Troubleshoot system components (e.g., input/output cards, and power supply).		
3.7 Complete system-level testing (e.g., SAT and FAT).		
3.8 Calibrate measurement instruments (e.g., level, pressure, flow, and temperature systems) using appropriate test standards and equipment.		
3.9 Describe the principles of signal and shield grounding and their effects on signal measurement and/or control loops.		
3.10 Perform tuning of simple control loops.		
3.11 Assist in changing hardware in an industrial network.		
3.12 Install hydraulic, pneumatic, and digital instruments (e.g., transducers, transmitters, control valves, switches, measuring devices, process analyzers, relays, alarm panels, and thermocouples).		
3.13 Maintain hydraulic, pneumatic, and digital instruments (e.g., transducers, transmitters, control valves, switches, measuring devices, process analyzers, relays, alarm panels, and thermocouples).		
4. Project Management	5-15%	5-15
4.1 Research equipment or component needs, sources, competitive prices, delivery times, or operational costs.		
4.2 Assist in the identification of client's objectives and application requirements.		
4.3 Prioritize own work activities to ensure that project objectives are met on time and on budget.		
4.4 Assist in estimating costs, materials, quantities and resources required for projects.		
4.5 Quantify one's work that is completed to-date.		
4.6 Report changes in own scope of work to the appropriate authorities.		
4.7 Establish and maintain effective working relationships with internal and external clients.		

4.8 Explain the value of workplace safety legislation.		
4.9 Comply with workplace safety legislation.		
Total	100%	100

Cognitive Level	Multiple-choice Questions	
	Target Range (% of Qs)	Target Range (# of Qs)
Knowledge	25-35%	25-35
Application	35-45%	35-45
Critical Thinking	25-35%	25-35
Total	100%	100

Question Type	Multiple-choice Questions	
	Target Range (% of Qs)	Target Range (# of Qs)
Questions with Images	25-35%	25-35
Questions without Images	65-75%	65-75
Total	100%	100