ONCAT Final Report:

2016-21- Electrical Techniques Ontario College Certificate to Electromechanical Engineering Technician Ontario College Diploma

March 15, 2017

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Project Team

The project team is comprised of representatives from Lambton College, Canadore College, Conestoga College, Niagara College and a hired Project Manager.

Lambton College Project Team Members:

1. **Bryan Aitken,** Project Manager
2. **Steve Minten,** eLearning Manager
3. **David Simon,** Coordinator, Program and Pathways Development
4. **Nadine Cervi**, Associate Faculty (English) and Pathways Research Consultant
5. **Stephen Tigchelaar,** Coordinator, Electrical Techniques

Canadore College Project Team Members:

6. **Mark Lamontange,** Dean, Trades, Technology, Law and Justice & Part-Time Studies
7. **Steven Lazarou,** Coordinator, Electrical Techniques

Conestoga College Project Team Members

8. **Steve Andrushak,** Program Coordinator, Electrical Technician Industrial Program & Electrical Techniques Program
9. **Josh Hamilton,** Adjunct Faculty, Electro-mechanical Engineering Technology

Niagara College Project Team Members:

10. **Jeff Murrell,** Associate Dean, School of Trades

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Executive Summary

The goal of this project is to provide a pathway for students graduating from Electrical Techniques, Ontario College Certificate programs into receiving Electromechanical Engineering Technician, Ontario College Diploma programs. Canadore College, Conestoga College, Lambton College and Niagara College have Electrical Techniques programs, while Conestoga College and Lambton College have an Electromechanical Diploma program.

The original design team began the project by investigating the gaps in the knowledge between students from first-year Electromechanical, and the one-year Electrical Techniques program. As anticipated, most of the gaps were mechanical in nature, with only a few gaps in electrical that could be picked up by modifications to current Techniques programs. These gaps were also compared to the Ministry of Advanced Education and Skills Development (MAESD) Program Standards to identify any deficiencies relative to these publications.

There was a delay during the summer and early fall, 2016 while several key individuals changed roles, left for other colleges, or found other employment. A new project team was assembled in October 2016, after which time the original gap analysis was finalized and the outcomes for two bridging courses were created. The necessary gaps were covered by outcomes in two courses - the Mechanical Principles bridging course and the Mechanical Practices bridging course. The outcomes for these courses were approved by the working team early in 2017, and then further refined into two course syllabi by the project lead.

A pivotal meeting was held on February 17, 2017, where the team approved the course outlines, and discussed the plan for the delivery mode for the two new bridging courses. The Mechanical Principles bridging course will be delivered in an entirely online format, while the Mechanical Practices bridging course requires verification of online skills. To accomplish this, a two-day intensive hands-on workshop will be required at the host college in addition to the online component. Using innovative 360-degree video instruction to teach the elements of the hands-on skills, this provides students the necessary background to attend the workshop.

The course outlines and the delivery plan will now be shared with the Subject Matter Experts (SME) for the final phase of the project. The SMEs will work with instructional design staff and videographers to develop the full course content, resources and evaluation tools. This will include development of the two-day intensive workshop for the Mechanical Practices bridging course. This detailed design will commence in April 2017, with a completion date by December 2017. This will permit the first delivery of the bridging courses to begin during the spring term in 2018, which will align with larger groups of Electrical Techniques graduates.

For system-wide application, any Ontario College that hosts an Electrical Techniques program can utilize the bridging courses into their respective Electromechanical programs. This type of collaboration and participation is an excellent way to create wonderful opportunities for students and graduates across the province. Each college may have some specialty content in their respective program that may

require additional bridging if deemed essential, but this should be minimal. The bridge covers all of the necessary elements of the Program Standards published by the Ministry of Advanced Education and Skills Development.

Project Purpose and Goals

The Electromechanical Engineering Technician, Ontario College Diploma is a two-year program that prepares graduates with the skills of both electricians and millwrights. With these skills, many career opportunities are available for a multi-discipline service technician in the fields of manufacturing, utilities, electrical and wind energy.

Since 2015, Lambton College has seen an incredible increase in applications for both the Electrical Techniques, Ontario College Certificate program (20%) and the Electromechanical Engineering Technician, Ontario College Diploma (100%). In this instance, the participating institutions recognize the importance of providing students, in service technician positions, with a strong skill set in both the mechanical and electrical fields.

The overall goal of this pathways project is to develop an innovative (and collaborative) pathway that will allow students to receive both an Electrical Techniques, Ontario College Certificate and an Electromechanical Engineering Technician, Ontario College Diploma in two years.

The intended (and future) project goals include:

1. Lambton College's commitment to creating a pathway for Electrical Techniques, Ontario College Certificate graduates from Canadore, Niagara, Lambton and Conestoga into the Electromechanical Engineering Technician, Ontario College Diploma. The following pathway with a bridge, will be created among Lambton College, Canadore College, Conestoga College, and Niagara College before expanding the pathway to other Ontario Colleges with the Electrical Techniques, Ontario College Certificate programs.

2. The future goal of the project is to expand the pathway to all Ontario Colleges that offer Electrical Techniques Ontario College Certificate programs once the pathway project has been completed.

All parties are committed to running the pathway for as long as the two programs are active at each of the participating Colleges.

To ensure that the following pathway project was completed on-time, the project responsibilities were initially separated into two different phases with specific timelines for the lead College and partner institutions to follow. Please see the original timeline below:

Phase one:

May 2016 - Lambton College and the partner institutions will create a project committee and enlist the required contacts at both institutions. The committee will work together to define what the seamless pathway will look like for students.

June 2016 - The project committee will determine a scheduled timeline of meetings in order to complete the project tasks. The committee will discuss the number of meetings that need to take place and the types of meetings (i.e. teleconference, in-person, etc.).

October 2016 - Documents such as course outlines, learning outcomes and syllabi will be submitted to the relevant committees at Lambton College from Canadore College, Conestoga College, and Niagara College for review and approval.

December 2016 – The interim report to ONCAT is submitted.

January - February 2017 - The pathway developed will be signed and approved. Once signed, a collaborative marketing strategy will be implemented by Lambton College and the respected partners.

March 15, 2017 - Final report to ONCAT is submitted.

Phase 2: Full Curriculum Development

April – December 2017 -Fully develop the course curriculum for the two bridging courses. Subject Matter Experts (SME) from partner colleges will supply the knowledge and the instructional design will be provided by Lambton College.

March 2017 - Credit transfer information is shared with other colleges with the hopes to build a strong multilateral agreement with other Colleges.

Submit the transfer agreement to the ONTransfer database for current and prospective students.

Project Management:

The committee met (in the beginning) by telephone or email. The initial meetings were used to discuss the project expectations, confirm timelines, and individual responsibilities.

The faculty leads for each committee reviewed the course outlines, course learning outcomes and syllabi to determine the appropriate credit transfer.

Once the pathway is completed, the bridge program will be developed. Lambton (and partners) will identify the minimum Grade Point Average (GPA) and other relevant eligibility standards for students for the established pathway. Based off of the curriculum/course outline review, transfer credits that will be granted to students entering the pathway will be determined.

When the agreement is complete, Lambton's Pathways Research Consultant will coordinate with ONCAT to update the Course-to-Course database with the relevant information. In addition, the Pathways Research Consultant will be the lead communicator for students and faculty looking to receive information about the following pathway program at Lambton College.

ONCAT Project 2016-21

Pathway Development

A) Methodology

The starting point for this project was the assembly of a project team with knowledge of either Electrical Techniques programs, Electro-mechanical programs, or both if possible. A consultant was hired to perform a gap analysis of skills between the programs in their first year compared to MAESD Program Standards. Next, the team reviewed the gaps for accuracy and viability. After this review, a project lead was hired to take the gap analysis and develop course outcomes for the required bridging courses. These outcomes were reviewed by the team and once the review was completed, the course syllabi were developed.

The review team approved the syllabus for each course **(Appendix B)** and made recommendations as to the modes of delivery **(Appendix E)**, completing Phase I of this project. This final design is presented for management approval in mid-March.

A new working group of SMEs will be assembled to start the full curriculum content design, and this will be implemented through instructional design. The team is anticipating using 360-degree video technology as an innovative approach to technical teaching.

Due to personnel changes, on December 5, 2016, a meeting was held between the institutional partners (by phone) to discuss the revised work plan for moving forward with the project. At the meeting, it was recommended and agreed upon that we proceed with the development of the bridging course outcomes in a parallel process to the final gap analysis by each college.

The revised plan below reflects the recommendation to proceed with the development of the bridging courses. The revised plan should not affect the deadlines for the project.

Revised Work Plan – Commencing December 6, 2016

Item	Work Description	Outcome	Timeline for completion
Assemble Work Team from the four partner colleges including Lambton	Some of the individuals initially involved have changed positions and a new team needs to be assembled and meet to bring up to speed on the project.	Team assembled and conference call	By December first week **Completed**
Team Review Gap Analysis as it relates to their colleges and simultaneously the draft outcomes for the bridging courses	Each college to review gap analysis for accuracy and any outlying gaps from their perspective – coordinate and participate in this for Lambton.	Summary of colleges gap results	December 6 to January 16 **Completed**
Develop bridging course outcomes for the two recommended courses	Lambton to develop and lead the bridging course outcomes – conforming to MAESD program standards also.	Preliminary draft outcomes	No later than December 15 **Completed**

Interim Report	Bryan Aitken to prepare the Interim report for ONCAT.	Report submitted on time	December 15 **Completed**
Final Bridging Outcomes	Lambton to prepare the final bridging outcomes, utilizing all the input received from the four colleges.	Final approved outcomes	January 18 **Completed**
Develop Course Outlines for the two bridging courses	Moving forward with approved outcomes – the team to review during this process.	Final Course Outlines including outcomes and syllabus	January 30 **Completed**
Approval out outlines	The team to review and approve the course outlines.	Final outlines	February 6 **Completed**
Pathway signed and approved	Work with colleges on final approval and develop a collaborative marketing strategy – input to this process.	Pathway approved	March 1
Final Report to ONCAT	Bryan Aitken and Lambton's Pathways Research Consultant to write the final report executive summary – have team and management review.	Final Report approved	March 15

Note: The partner college teams have held face-to-face meetings on two occasions at Conestoga College, which was the most central meeting location to all the partners. This type of meeting was deemed best for interaction during the initial gap analysis component, and also for the final review of the outcomes, syllabi, and delivery modes. Additional full or partial team member meetings were conducted by teleconference because it was the most efficient use of people's time to keep the project moving forward.

B) Program Comparison and Analysis

The gap analysis for this project involved comparing the Ministry Program Standard outcomes for both programs as well as a comparison of the four Electrical Techniques programs and the two Electromechanical Diploma programs for their relative compliance to the MAESD Standards. This created a summary of gaps that students would need to bridge for successful transfer from Electrical Techniques programs at any partner college to a host Electromechanical Diploma program.

It was interesting to note the difference in college offering of Electrical Techniques and Electromechanical Diploma. Specifically, very few of these differences were gaps as compared to the Program Standards, more tended to be areas of expertise where each college went beyond the Program Standard. Examples of this are Robotics at Conestoga College and Pumps and Process systems at

Lambton College. This does provide some challenges for students who are bridging into the host college programs, where they may need to pick up one of these additional specialty items as well. This anomaly will be addressed by each host college if necessary. As these topics are further enhanced in the second year of Conestoga College and Lambton College programs, it may not be necessary to provide students with anything more than the bridge resulting from this gap analysis and subsequent pathway development.

After identifying the project team, a consultant was contracted to conduct an investigation of the gaps between the Electrical Techniques Program Standard, and the Electromechanical Technician Program Standard. The consultant also looked at each college program to determine any gaps that were evident from the standards. This gap analysis was then reviewed by each of the partner college (**see Appendix A**). A contract was then released for a project lead, once the gaps were identified, to develop the program outcomes, and then to create the course syllabi necessary to address these gaps.

The full curriculum design of the two courses, based on the course outlines developed during pathway design, are the following:

1. Mechanical Principles Bridge
2. Mechanical Practices Bridge

The course outlines for the above courses are presented in **Appendix B**. The curriculum design phase of this program will follow and be reviewed for quality assurance measures.

Note: The bridging method of providing a pathway from Electrical Techniques to Electromechanical was determined to be the best method as agreed by all partner colleges involved. As described in this report, it was truly a collaborative effort of the colleges to determine the gaps and develop the bridge. Worthy of note is the need to hold a two-day workshop to verify hands on skills for the Mechanical Practices course. This was supported by all partner colleges in addition to the online learning format of the bridge.

In addition, the entry point for the pathway was quite clear from the outset of the project. Students graduating from the Electrical Techniques program would be eligible to then complete the bridge over a spring semester online, progressing directly into the second year of a host college's Electromechanical Diploma program. If any anomalies over and above the standard curriculum exist at a particular college, that college would deal with the requirements, but not impede a student entering the second year of an Electromechanical Diploma program. This may potentially require a student to take one additional course if the anomaly is deemed essential to their program.

C) Implementation Process and Timeline

The pathway implementation process and timeline for this project will commence in May, 2018. The partner institutions have worked together to maintain the revised work plan timelines in order to meet the implementation date.

Please see below for the next implementation dates for moving forward with this pathway project:

Action Item	Implementation Date
Pathway and Bridge Design	March, 2017
Bridge Courses	May, 2018

The communications plan will include the following steps:

1. First, each partner institution will receive a draft copy of the agreement for review. Feedback regarding the agreement will be requested from all schools to ensure that the information is accurate.

2. Next, the agreement, once approved, will be circulated to each partner institution for signatures.

   Note: When the agreement is complete, Lambton College's Pathways Research Consultant will coordinate with ONCAT to update the to update the Course-to-Course database with the relevant information

3. After the agreement is signed, an online and written marketing communications plan will be developed. This marketing plan will commence in January 2018.

4. Finally, all partner institutions will update their school's website to include information on the transfer opportunities available for graduates of the Electrical Techniques Ontario College Certificate.

Summary of Pathway Created

The table below provides details about the 2016-21 Electrical Techniques, Ontario College Certificate to Electromechanical Engineering Technician, Ontario College Diploma pathway development project:

PATHWAY DETAILS	
Title of Pathway: Use Official Program/Credential Titles	From: Electrical Techniques Certificate To: Electromechanical Engineering Technician Diploma
Pathway Type: *Degree Completion, Certificate to Diploma, Diploma to Diploma, Degree to Diploma, etc.*	Certificate to Diploma

List other postsecondary institution/s involved in the creation of the pathway:	Lambton, Conestoga, Canadore and Niagara
Pathway Implementation Date (Senate approval):	May, 2018
Pathway Implementation Date (posting to the ONTransfer.ca website):	January, 2018
Contact Procedure for Pathway Implementation:	Lambton College's Pathways Research Consultant to coordinate with ONCAT to update the Course-to-Course database with the appropriate pathway details.
Eligibility for the Pathway (student eligibility for the pathway):	Electrical Techniques program at any Ontario College
Applicant must have graduated from the program at the sending institution:	Yes
Minimum program GPA or % required to be eligible for this pathway:	2.0
Minimum GPA or % required in specific courses	N/A
Total number of transfer credits / full courses to be granted at receiving institution (please express as a numerical proportion, i.e. 90 of 120)	45 of 86 credits
Transfer Credits Granted (please describe pathway clearly and succinctly):	Communications College Orientation Electrical Theory Electronic Devices Safety and Electrical Code Electrical Installation Basics

	Basic Mathematics Drawing and Schematics Fundamentals of Instrumentation General Education Elective
Total number of program courses that must be completed at the receiving institution in order to graduate (please express as a numerical proportion, i.e. 90 of 120):	41 of 86 credits + 7 credits (2 bridging courses)
Anticipated time to complete the credential if enrolled full-time:	One calendar year which includes the bridging program (i.e. September to August)
List of eligible institutions and their programs	Conestoga College, Electromechanical Maintenance Lambton College, Electromechanical Engineering Technician

Promising Practices and Lessons Learned

A) Promising Practices

An essential component of this pathway project is to provide a seamless pathway for students, enhancing their potential career options. Each partner institution believed the pathway development "could be done," thus emphasizing a clear project definition and goal which resulted in two bridging courses that will provide this pathway as anticipated.

Specifically, one practice that was implemented at the start of the pathway development was to have one college lead on the analysis and documentation, and then reviewed, critiqued, and enhanced by the partner team members. This practice was the most efficient way for moving this project forward.

B) Lessons Learned

One key lesson learned is to ensure that there are more than one manager and/or faculty aware of the project and content at each partner college. This project suffered from a significant delay when key personnel changes happened only 3 months into the analysis phase. This took another three to four months to recover from because new team members needed to be located and then engaged in what the project entailed.

A process such as this could get bogged down in the gap analysis. Each partner must be willing to give and take on what gap is essential to the success of students taking such a pathway, or what gaps are of the "nice to have" type. Once this type of dialogue and compromise can be followed, then a successful bridge that will produce a successful pathway can be forged.

Appendix A – The Draft Bridging Program Outcomes and Working Plan

Please see below for the draft bridging program outline and working plan:

Note: The text in red, with strikethrough, are items that were discussed and deemed not a necessary component of the bridge.

GAP Module Headings	Diploma Outcomes	GAP Module Outcomes	Minimum Requirement at End of Year 1
ONLINE DELIVERY MODULES			
Drawing (CAD)		• Mechanical drawings/symbols	Graduates of an ELT program will have varying exposure to CAD software (some perhaps with none). Individual colleges will need to decide on how much allowance students will be given to skill up into the particular CAD of choice at the receiving institution.
Documents	11a)	**Schedule:** ~~follow maintenance schedules~~	• 2nd year level of learning
	9 a) to j)	• All (follow-up for further qualifications) • Charts, tables and graphs • Interpreting, organizing and preparing? a) Prepare technical documentation such as operator procedures, maintenance procedures, repair procedures, and installation procedures b) Interpret and use information from technical manuals c) Manage electronic and/or paper-based systems to store and retrieve information d) Maintain current, clear, and accurate	Students will need to read, interpret, and understand Mechanical Terms and definitions as well as symbols/ Drawings - defining inventory control processes. This is a gap of depth and breadth with respect to mechanical terms, definitions and symbols. All of this is basic theory / knowledge (suitable for online learning – memorization, quizzes, etc.). This should also include a refresher on industrial electrical terms and symbols.

		electromechanical engineering-related documents e) Use records and inventories to prepare reports f) Prepare and maintain parts inventory and installation records g) Prepare and maintain maintenance and service logs h) Document clearly work processes such as problem-solving methodologies, troubleshooting procedures, and prototype evolution (e.g., problems, modifications) i) Follow established procedures of inventory control j) Document the design, testing, modification, and application of electrical, electronic, and mechanical equipment and systems	
	3 b)	~~b) Use a variety of references including colleagues, manufacturers' manuals, handbooks, and electronic references (e.g., Internet, cloud-based) to complete troubleshooting~~	2nd year concept - they will get exposure to handbooks in an Introduction to Machining course, but mostly higher level when getting into manufacturers' manuals, etc. "Machinists' Handbook" becomes part of their "toolbox" – needs to be listed as a resource. Could be some value in having some content in an online module – "Mechanical Theory" perhaps.
Math / Science / Engineering		• For investigation (i.e. Algebra, Trigonometry, Calculus) see: Steve from Conestoga	Some colleges don't have trigonometry, and others could use a refresher.

			Solve technical geometric problems involving length, perimeter, area, surface area, and volume of geometric figures using algebraic methods. ~~Statistics ?~~
	5 e)	*Use mathematical and scientific terminology accurately*	This will be covered off by the above.
	3 c)	~~Apply mathematical and scientific analysis in accordance with the principles and practices of electromechanical engineering~~	• 2nd year level of learning
	6 r)	~~Apply superposition and Thevenin's theorems to analyse AC and DC circuits~~	2nd year level of learning - all colleges are doing loop analysis of circuits, for combination circuits, 3-wire Edison circuit.
	6 t)	~~An analyse resistance, inductance, capacitance (RLC) circuits~~	2nd year fundamental knowledge form DC theory is the foundation of all these concepts and should not need anything to prepare.
	6 u)	~~Identify, analyse, and distinguish waveform properties~~	2nd year - there may be some of this at the identification and distinguish level in first year, but no analysis.
	6 g)	Solve efficiency, power loss, and energy problems ~~in electrical~~ and hydraulic systems	• 2nd year (only partially) This is "power factor correction" in electrical (definitely a second year concept). Bridging gap is foundational hydraulic theory/principles. Perhaps not the calculation aspect, but the foundational knowledge. Does this tie in to geometry piece? This aligns with the gap in the math. Learn geometry and apply it into hydraulic problems.

Automation / Robotics	8 (a-e)	~~a) Analyse the effectiveness of robots in a variety of industrial processes~~ ~~b) Troubleshoot integrated robotic systems~~ ~~c) Test a variety of digital display and recording processes and systems~~ ~~d) Install, maintain and repair automated manufacturing equipment found in manufacturing facilities~~ ~~e) Apply knowledge of robot operating protocol~~	2nd year, higher end application of both electrical and mechanical knowledge together in automation systems.
Electronic	6 v)	~~Identify and select analog semiconducting devices to meet job requirements and functional specifications~~	• 2nd year higher level of application of semiconductors Fundamental exposure to basic semi-conductors in the ELT program, but not higher level analysis.
Electromechanical	12 k)	• Equipment • Processes • Systems • Sub-systems Apply knowledge of safety products such as safety relays and safety interlock devices and ground fault circuit interrupters	Ground Fault Interrupters? Recognize the proper application of ground fault interrupters, how they work and the correct application of them.
Mechanical Theories		• Basic mechanical knowledge, conversions, weights, measurements, physics problems • Property of materials, • Laws for fluid and pneumatics • Pressures • Basic Engineering principles (problem solving method)	Basic mechanical knowledge focused on metrology, using the various measuring devices such as dial indicators, micrometers, verniers etc.
	10 i)	~~Recognize the importance of using standardized parts to facilitate troubleshooting and reduce spare parts inventory~~	• 2nd year higher application of knowledge

	5 c), d) and h)	~~c) Analyse properties of materials and assess their suitability for use in a mechanical system~~ ~~d) Recognize the effects of manufacturing processes on materials and on the design and production of components~~ ~~h) Apply knowledge of manufacturing techniques to support the manufacturing and handling of components~~	• 2nd year metallurgy
	6 b)	**Circuits:** ~~Apply electromechanical knowledge to single- and three-phase industrial and domestic electrical distribution~~	Single phase is covered in ELT. The third phase is in the 2nd year.
	12 b) and c), e), f) and g)	b) Adhere to applicable workplace codes including those relating to electrical and mechanical work environments, explosive environments, hazardous material handling, and safety c) Comply with all relevant occupational health and safety requirements[1] and applicable sections of the Technical Standards and Safety Authority (TSSA) and the Ontario Electrical Safety Code (OESC) e) Test, store, and handle electrical, electronic, and mechanical equipment according to industry standards (e.g., American National Standards Institute, electrical codes) f) Apply regulatory and licensing requirements (e.g., NEMA ratings) when completing installations,	Exposure to mechanical safety procedures around Kinetic energy, heat, rotating equipment etc. as well as areas of TSSA and Occupational Health and Safety.

		maintenance, and repairs of electrical, electronic, and mechanical equipment g) Conduct safety inspections of the workplace to detect, report, and correct, where possible, hazardous conditions	
Quality Assurance		• ISO standards	
	3 g)	~~Follow established service schedules~~	• Same as 4 c)
	11 g)	Apply functional specifications, procedures, and relevant Standards applicable to electromechanical engineering	First year students are always following relevant standards; just the "electromechanical engineering" aspect is a bridging gap. "Mechanical Handbook" already identified. See notes under 3b) above.
	4 c)	~~Establish and~~ follow regular inspection and service schedules	• 2nd year application in terms of "establishing" schedules Not a bridging gap.
Computer Skills		• Hardware • Software • Programing	Bridge needed for basic programming, IOs, relays, timers, counters, ladder logic (all under PLC) – perhaps specific only to some Colleges?
	7 a)	~~Select, configure, install, and troubleshoot industrial communication protocols~~	• 2nd year higher level learning
	7 c)	~~Apply knowledge of hardware and application software to maintain effective computer operations (e.g. write a maintenance procedure)~~	• 2nd year knowledge PLC/ Automation **Note**: Some colleges have 2 PLC courses with a 1st year PLC course; therefore, they may want to consider offering it in 3rd term or in advance of 3rd term start for bridging students.

Equipment		~~• Selection, purchase~~ • ~~Design requirements~~	• 2nd year machines and equipment course
	3 f)	~~Upgrade equipment when appropriate~~	
IN-SHOP MODULES			
Mechanical Practical skills			
	1 j)	**Fabricating:** ~~• Apply engineering principles to the analysis and construction of mechanical components and assemblies~~	• 2nd year part of Metallurgy
	1 f)	**Machining:** • Use basic machine shop skills such as turning, milling, metal bending, drilling, tapping, machining, and cutting according to job specifications	Huge gap - how do we get them to cover the understanding here; do they need to take a machine course prior to starting the second year or could it be at the same time? Could have them take the 1st year course while attending the 2nd year as it is not prerequisite; take Gen Ed in summer.
	1 b)	**Soldering:** • Apply soldering and desoldering techniques	**Gap? Recommend that this is in electrical techniques courses.**
	1 c)	• Assemble printed circuit boards (PCB)	**Gap?**
	1 e)	**Maintain, Repair, and Troubleshoot:**	They will pick up the "mechanical" portion in the bridge somewhere.

Mechanical Practical skills (Cont.)		• Repair and replace electrical, electronic, and mechanical components	This is a "trade-related" concept with application across all trades.
	11 b) and 11 d)	~~b) Apply preventive and predictive maintenance techniques~~ ~~d) Inspect components using appropriate measuring instruments as required~~	• 2nd year higher level of learning applying fundamental knowledge
	5) – a, b, e, f, g	~~• Support the design and production of mechanical components by assisting in the specification of manufacturing materials and processes (talk to ElecMech faculty to find out at what level is required)~~ ~~a) T~~roubleshoot, source, and select mechanical power transmission components and systems ~~b) Analyse mechanical components and prototypes used in manufacturing processes and systems~~ ~~e) Use systematic approaches to assist in the identification and resolution of technical problems~~ ~~f) Identify and apply material testing methods~~ ~~g) Assist in sourcing material, tools, equipment, supplies, and services related to production of components~~	• 2nd year knowledge
	3 a)	**Measuring:** • Use standard mechanical, electrical, and electronic testing and measurement equipment such as scopes, digital multimeter, protocol analysers, cable testers, calipers, verniers, and voltmeters	• Metrology (note this is covered in Lambton's 1107/ Machining course) • Multimeters are covered in ELTC

	4 a) d)	a) ~~Install, configure, and commission components, equipment, and systems~~ ~~d) Select, install, troubleshoot, and repair and modify equipment to keep operations running efficiently~~	• 2nd year applications These are also trade-related concepts so students will have foundational knowledge.
	6 w), 4 f), 4 h), g)	**Electronic:** ~~• Software~~ ~~6 w) Analyse and troubleshoot circuits such as linear and non-linear amplifiers, oscillators, pulse circuits, and active filters using discrete components and integrated circuits, phase-locked loops (PLL) and frequency synthesizers, power supplies, and semiconductor gating circuits~~ ~~4 f)~~ Test, troubleshoot, and ~~repair typical electromechanical systems such as replacing wiring, fluid power* valving, piping, and electromechanical devices~~ ~~g) Repair electrical and electronic systems, including devices, subsystems, wiring, and cabling to circuit board level~~ ~~h) replace circuit boards (e.g., motherboards)~~	2nd year higher application of foundational knowledge
	11 i)	• **Mechanical:** • ~~Program test equipment to generate appropriate test vectors~~	• 2nd year preventive and predictive maintenance
	3 d)	• ~~Use the correct testing equipment and setup for the accurate assessment of equipment performance~~	• 2nd year level – vibration assessment, ultrasonic, etc.
	3 e)	• ~~Test, maintain, and repair equipment~~	• 2nd year PPM course

			This is a trade-related concept so students will have foundational knowledge.
	1 k)	• ~~Apply knowledge of mechanical, electrical, electronic, and automation technologies to solve routine problems and complete electromechanical engineering tasks~~	• 2nd year automation course
	3 h)	• ~~Diagnose electromechanical system problems using appropriate test instrumentation, schematics, and technical reference manuals~~	• 2nd year automation course and equipment and machines
	3 i)	• ~~Determine whether a fault is electrical, electronic, software, or mechanical in nature~~	• 2nd year automation/ PLC courses They will pick up introduction to the "mechanical" portion in the bridge somewhere.
	4 f)	• Test, troubleshoot, and repair typical electromechanical systems such as replacing wiring, fluid power* valving, piping, and electromechanical devices	Pumps and valves piping and seals: 1) Describe the different types of pumps; OL 2) Identify the different applications for the pumps and the various maintenance requirements for pumps; OL 3) Identify the different types of valves used in industry and maintenance required; OL 4) Identify the different types of piping, flanges and fittings; OL 5) Interpret and create basic industrial piping isometrics; OL 6) Demonstrate the ability to use piping related equipment; 2nd year

			7) Demonstrate the knowledge to select, install and maintain static and dynamic seals; 2nd year 8) Demonstrate the ability to interpret seal catalogues; OL
Circuits	1 g)	**Electrical:** • ~~Design, test, and troubleshoot electrical panel assemblies~~	• 2nd year course
	1 h)	**Electronic:** • ~~Logic~~ • ~~Digital~~ • ~~Passive/Active AC/DC~~ ~~h) analyse components of a breadboard and a PCB~~	• 2nd year course
	7 a)	• ~~Select, configure, install, and troubleshoot industrial communication protocol~~	• 2nd year course This is a PLC communication piece.
	6 b)	• ~~Apply electromechanical knowledge to single- and three-phase industrial and domestic electrical distribution~~	• 2nd year higher level application of knowledge Have foundational knowledge of the Edison circuit.
	6 c)	**Digital:** • select and troubleshoot analog and digital sensors	Gap of exposure to sensors – what they are, what a proximity switch is, what a limit switch is. May be able to combine with hydraulics.
	6 d)	• use, adjust, and maintain instrumentation	
	6 k) & L), o) and p)	k) Integrate electronic control equipment (e.g., discrete devices, PLCs, sensors, robot application programs) into typical small Computer Integrated Manufacturing (CIM) work cell environments so that an overall system performs to specification	Boolean logic is a gap but the rest is higher level learning.

		l) Apply Boolean logic to industrial control systems o) Analyse and troubleshoot circuits which have programmable logic devices (PLD) p) Analyse and troubleshoot combinational logic circuits, sequential logic circuits, and analog-to-digital and digital-to-analog conversion circuits	
Fluid Power	6 f)	• ~~Build, test, and troubleshoot mechanical systems, pneumatic circuits, and hydraulic components and systems~~	• 2nd year Hydraulics and Pneumatics course
	6 h)	• Test and measure fluid pressures and flow characteristics	Need to bridge basic fluid power (pressure and flow characteristics).
	6 i)	• ~~Test electrical, electronic, and mechanical controls used in electrical and fluid power* systems~~	• 2nd year Hydraulics and Pneumatics and Automation courses
	6 j)	• Integrate motion control and electrical and fluid power* equipment	Need to bridge hydraulic/pneumatic/fluid power symbols
PLC	6 e)	• ~~Apply, install, test, and troubleshoot Programmable Logic Control (PLC) systems, working with a variety of industrial components and machinery~~	• 2nd Year PLC/Automation

Appendix B – Mechanical Principles Bridge and Mechanical Practices Bridge Course Outlines

Mechanical Principles Bridge

Department

Course Number:	**Co-Requisites:**	**Pre-Requisites:**
IMT-xxx3		MTH1084 or MTH1105
Prepared By:	Bryan Aitken, P. Eng.	
Approved By:		
Approval Date:	Draft January 30, 2017	
Approved for Academic Year:	2018-2019	
Normative Hours:	45	

Course Description

This is one of two courses to bridge the gap from Electrical Techniques programs to Electromechanical Engineering Technician programs. Applied science principles will be applied to mechanical topics relevant to the profession, leading into applied topics of machine components and assemblies, machine drives, lubrication, and then applied to a systems overview of pneumatic, hydraulic and fluid systems. Mechanical drawings and documentation will be introduced, as well as safety and maintenance programs.

Course Learning Outcomes / Course Objectives

1) Establish and maintain safe work environment, habits, and procedures.

- 1.1 Explain the necessary elements of safe work and a safe work environment.
- 1.2 Describe how safe work habits are gained and maintained.
- 1.3 Explain the purpose of plant safety programs, and typical structure.
- 1.4 Describe the role of Health and Safety committee member from a maintenance employee perspective.
- 1.5 Explain how safe work procedures are created, and the importance of following them in every situation.

2) Interpret mechanical documents in preparation for Electromechanical tasks.

- 2.1 Read charts, tables, codes, standards, and other resource materials to extract usable data.

2.2 Read and interpret orthographic projections, Multiview projections, and auxiliary views of machine components.
2.3 Read and interpret assembly and detail drawings of machine components including bills of material.
2.4 State the principles of geometric tolerancing and symbols.
2.5 Read and interpret basic weld symbols.
2.6 Read and interpret pneumatic and hydraulic component symbols in both ANSI and ISO systems.

3) Define and calculate parameters required for mechanical tasks utilizing necessary principles of Applied Science.

3.1 State the basic principles of friction and stresses in machine parts with a non-mathematical approach.
3.2 Calculate belt, chain, and gear drive speeds and speed ratios given the geometry of the system.
3.3 Discuss, describe and/or identify various physical scientific properties and relate them to practical applications.
3.4 Solve, analyze and summarize analytical and non-analytical problems involving velocity and acceleration, heat and energy, fluid power and hydraulics.

4) Describe the purpose for, and explain the operation of typical mechanical components found in machinery.

4.1 Explain the parts and application of the common types of journal and rolling-element bearings, including the necessary seals where applicable.
4.2 Explain the basic operation of gear drives, belt drives, chain drives including couplings, clutches, and brake systems.
4.3 Describe lubrication systems, standard oils and greases, and methods of lubrication.

5) Explain the purpose for, and components of various electromechanical systems.

5.1 Describe and apply the basic principles, terms, applications and safety procedures pertaining to pneumatic, hydraulic and fluid systems.
5.2 Describe fundamentals of industrial hydraulics and the standard components.
5.3 Describe the components and purpose of various types of equipment including; pumps, compressors and fans, stationary engines, conveyors, vessels and heat exchangers, furnaces and boilers.

6) Describe the most common maintenance programs used in industry and identify the benefits and weaknesses of each.

6.1 Describe/identify the various characteristics, measurements and analysis techniques with respect to commonly used maintenance practices.

Learning Resources

Required:

160101a Safety Legislation and industry Policy in the Trades 2.1 160101c Hazardous Materials and Fire Protection 2.1 160102a Measuring 7.1 160102bA Measuring Tools - Part A 11.0 160102bB Measuring Tools - Part B 10.0 160102c Layout 8.0 160102d Metallurgy 6.2 160103aA Hand Tools - Part A 6.1 160103aB Hand Tools - Part B 7.1 160103f Threaded Fasteners and Locking Devices 10.1 160103g Non-Threaded Fasteners and Locking Devices 7.2 160103h Installation and Removal of Fasteners 6.3 160103c Grinders 6.1 160103d Power Saws 5.3 160104a Drilling 9.1 160104b Milling 8.1 160104c Lathe components and Accessories 6.0 160104d Lathe Operations 9.2 150102c Speeds, Feeds and Cutting Tools 5.0

160301g Pneumatic Systems
160301aA Introduction to Hydraulics-Part A
160301aB Introduction to Hydraulics-Part B

Supplemental:

- Audel's Millwright and Mechanics Guide
- The Starrett Book for Student Machinists

Student Evaluation

Term Tests	**70**
• Theory and Calculations 20	
• Machine parts and Systems 30	
• Documentation and Maintenance 20	
Final Exam	**30**
• Comprehensive	

Grade Scheme

The round off mathematical principle will be used. Percentages are converted to letter grades and grade points as follows:

Mark (%)	Grade	Grade Point	Mark (%)	Grade	Grade Point
94-100	A+	4.0	67-69	C+	2.3
87-93	A	3.7	63-66	C	2.0
80-86	A-	3.5	60-62	C-	1.7
77-79	B+	3.2	50-59	D	1.0
73-76	B	3.0	0-49	F	0.0
70-72	B-	2.7			

Prior Learning Assessment

Students who wish to apply for prior learning assessment and recognition (PLAR) need to demonstrate competency at a post-secondary level in all of the course learning requirements outlined above. Evidence of learning achievement for PLAR candidates includes:

- Challenge Exam

Course Related Information

The course is structured with 3 hours of theory instruction/ week through the semester. Theory lessons will require reading material from the textbooks in preparation for the lecture topics. Attendance and participation in course materials and discussion groups, maintaining notes, completing self-directed study or assignments and successful completion of tests are all important components to successfully complete the course.

There will be reading assignments associated with all of the topics covered. Homework assignments will be given at the discretion of the instructor. Students will be evaluated on the basis of attendance, participation, assignments, projects, homework and tests. Late submissions will be penalized 10% per day unless arrangements were made in person for an extension. A maximum of 5 days late at which point a grade of zero will be awarded.

Department Related Information

School of Technology, Energy & Apprenticeship Missed Evaluation Policy In general, only illness and domestic affliction (i.e. death in the family, sick children, legal appointments etc.) will be considered as valid reasons for a missed or late evaluation (test, quiz, assignment, or lab). In cases where, in the judgment of the instructor, other circumstances clearly beyond the control of the student (i.e. Co-op Job Interviews, Jury duty, etc.) have led to a missed evaluation, consideration may also be granted. In the event a student misses an evaluation, the student must attempt to: Contact the instructor in advance, if at all possible, informing the instructor of the particular situation and attempt to make alternate arrangements. Presented with a valid reason for a missed test, the instructor will consult with the student to set up a mutually agreeable test date. The instructor will provide a suitable test at that time and mark it. For other missed or late evaluations, the instructor may instill a penalty, any of which the student will be made aware of at the beginning of the course. • In the event a student cannot contact the instructor in advance, the student must: Inform the instructor in writing as soon as possible after the missed evaluation and attempt to make alternate arrangements. • In all cases in which a student seeks remedy for a missed evaluation, the instructor may require a medical certificate or other substantiating documents by way of validation. When, in the judgment of the instructor, the student's reason is invalid, the student shall be refused any further remedy. The decision of the instructor not to allow the student the opportunity to reschedule the evaluation may be appealed under the Academic Appeal policy which is available on the Web under Registration on the Current Student page.

College Related Information

Academic Integrity

Lambton College is committed to high ethical standards in all academic activities within the College, including research, reporting and learning assessment (e.g. tests, lab reports, essays). The cornerstone of academic integrity and professional reputation is principled conduct. All scholastic and academic activity must be free of all forms of academic dishonesty, including copying, plagiarism and cheating.

Lambton College will not tolerate any academic dishonesty, a position reflected in Lambton College policy. Students should be familiar with the Students Rights and Responsibilities Policy, located on the myLambton website. The policy states details concerning academic dishonesty and the penalties for dishonesty and unethical conduct.

Questions regarding this policy, or requests for additional clarification, should be directed to the Lambton College Centre for Academic Integrity

Students with Disabilities

If you are a student with a disability please identify your needs to the professor and/or the Accessibility Centre so that support services can be arranged for you. You can do this by making an appointment at the Accessibility Centre or by arranging a personal interview with the professor to discuss your needs.

Student Rights and Responsibility Policy

Acceptable behaviour in class is established by the instructor and is expected of all students. Any form of misbehaviour, harassment or violence will not be tolerated. Action will be taken as outlined in Lambton College policy.

Date of Withdrawal without Academic Penalty

Please consult the Academic Regulations and Registrar's published dates.

Waiver of Responsibility

Every attempt has been made to ensure the accuracy of this information as of the date of publication. The content may be modified, without notice, as deemed appropriate by the College.

Students should note policies may differ depending on the location of course offering. Please refer to campus location specific policies:

- Lambton College - Sarnia Campus: https://www.mylambton.ca/Policies/
- Lambton College - Non-Sarnia Campuses: https://www.mylambton.ca/CESTAR/Student_Policies/

Note: It is the student's responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Mechanical Practices Bridge

Department

Course Number:	**Co-Requisites:**	**Pre-Requisites:**
IMT-xxx3		MTH1084 or MTH1105
Prepared By:	Bryan Aitken, P. Eng.	
Approved By:		
Approval Date:	Draft January 30, 2017	
Approved for Academic Year:	2018-2019	
Normative Hours:	60	

Course Description

This is the second of two courses to bridge the gap from Electrical Techniques programs to Electromechanical Engineering Technician programs. This course will introduce general millwright maintenance skills and subsequently basic machine shop skills. The emphasis throughout will be the development of troubleshooting, measurement, and repair skills in a safe and effective manner.

Course Learning Outcomes / Course Objectives

7) Develop and maintain a safe work environment, habits and procedures.

- 7.1 Communicate effectively by means of verbal, written, and visual representation, about maintenance and machining operations and details.
- 7.2 Explain the necessary elements of safe work methods, and define a safe work environment.
- 7.3 Explain the necessary actions if something is deemed unsafe.

8) Demonstrate proper basic mechanical maintenance skills following established procedures.

- 8.1 Demonstrate precision measurement within given standards in Imperial and Metric units.
- 8.2 Demonstrate skills in the use of hand and power tools commonly utilized in mechanical maintenance.
- 8.3 Perform standard lubrication procedures on mechanical equipment.
- 8.4 Diagnose operating problems with gear drives, belt drives, chain drives including couplings, clutches, and brake systems.
- 8.5 Assemble and disassemble mechanical systems using arbor press, hydraulic press, air tools, pullers, splitters, and slide hammers.

9) Demonstrate proper basic skills utilizing machines found in the typical machine shop.

9.1 Select and apply the appropriate procedures, materials, and tools, for altering or producing mechanical components.

9.2 Correctly operate machine shop equipment to create part geometry to given tolerances and surface conditions.

9.3 Sketch assembly and component parts using orthographic, isometric and sectional views with relevant dimensions and notes.

10) Troubleshoot and repair electro-mechanical equipment following accepted safety and maintenance procedures.

10.1 Perform standard maintenance tests on mechanical power transmission systems.

10.2 Perform measurement and analysis techniques utilized in commonly used maintenance practices.

11) Demonstrate the ability to work as part of a team to safely perform shop exercises following written and verbal instructions.

11.1 Follow maintenance procedures and safety protocols to perform specified tasks.

Learning Resources

Required:

160201fA - Lubrication – Part A - 6.0 - 52 160201fB - Lubrication – Part B - 6.1 - 56 160202bA - Anti-Friction Bearings - Part A - 7.0 - 56 160202bB - Anti-Friction Bearings - Part B - 6.1 - 52 160202c - Plain Bearings - 5.1 - 56 160202dA - Bearing Maintenance – Part A - 7.1 - 56 160202dB - Bearing Maintenance – Part B - 7.1 - 36 160202dA - Belts – Part A - 8.0 - 48 160202dB - Belts – Part B - 8.0 - 36 160202eA - Chains – Part A - 7.1 - 52 160202eB - Chains – Part B - 5.1 - 32 160202f - Gearing Fundamentals - 6.1 - 56 160202g - Gear Installation and Maintenance - 7.1 - 44 160202h - Variable-Speed Power Transmission Devices - 6.1 - 44 160202a - Shafting, Fits and Accessories - 9.0 - 28 160202c - Clutches and Brakes - 4.1 - 44 160202b - Couplings - 3.0 - 60 60105b - Rim and Face Shaft Alignment - 5.1 - 32 160204a - Cross-Dial Alignment - 8.0 - 40 160403c - Advanced Alignment - 6.0 - 48 160303a - Laser Shaft Alignment - 4.1 - 24 160201e - Bearing seals and pillow blocks - 6.1 - 44

Supplemental:

- Audel's Millwright and Mechanics Guide
- The Starrett Book for Student Machinists

Student Evaluation

Term Tests		**50**
• General Maintenance	25	
• Machine Shop Practices	25	

Practical Assessment	
• Hands-On Two Day assessment	**20**
Final Exam	**30**
• Comprehensive	

Grade Scheme

The round off mathematical principle will be used. Percentages are converted to letter grades and grade points as follows:

Mark (%)	Grade	Grade Point	Mark (%)	Grade	Grade Point
94-100	A+	4.0	67-69	C+	2.3
87-93	A	3.7	63-66	C	2.0
80-86	A-	3.5	60-62	C-	1.7
77-79	B+	3.2	50-59	D	1.0
73-76	B	3.0	0-49	F	0.0
70-72	B-	2.7			

Prior Learning Assessment

Students who wish to apply for prior learning assessment and recognition (PLAR) need to demonstrate competency at a post-secondary level in all of the course learning requirements outlined above. Evidence of learning achievement for PLAR candidates includes:

- Challenge Exam
- Practical skills assessment

Course Related Information

The course is structured with 3 hours of theory instruction/ week through the semester and a 2 day – 14 hour on campus practical assessment of skills during a weekend towards the end of the program. Theory lessons will require reading material from the textbooks in preparation for the lecture topics. Attendance and participation in course materials and discussion groups, maintaining notes, completing self-directed study or assignments and successful completion of tests are all important components to successfully complete the course.

There will be reading assignments associated with all of the topics covered. Homework assignments will be given at the discretion of the instructor. Students will be evaluated on the basis of attendance, participation, assignments, projects, homework and tests. Late submissions will be penalized 10% per

day unless arrangements were made in person for an extension. A maximum of 5 days late at which point a grade of zero will be awarded.

Preparation for the practical assessment will be accomplished via high technology 360 videos throughout the term. Attendance at the practical assessment is mandatory otherwise a passing grade will not be granted.

Department Related Information

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Note: It is the student's responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.

Appendix C – Key Milestones

The following table outlines the key milestones for the project:

Id.	Title	Planned completion date	Forecast completion date as reported two months ago	Forecast completion date as reported last month	Current forecast completion date	Actual completion date
1	Original Project Meeting	25-05-16				25-05-16
2	Gap Analysis Work	24-06-16				24-06-16
3	Gap Analysis Discussion – All Partner Colleges	24-06-16				24-06-16
4	New Team Meeting regarding Path Forward and Outcomes	30-11-16				5-12-16
5	Course Draft Learning Outcomes	12-12-16	31-10-16		12-12-16	31-12-16
6	Final Approved Outcomes and Methodology	18-01-17			18-01-17	18-01-17
7	Course Outlines Approved	30-01-17	30-12-16		30-01-17	17-02-17
8	Pathway Developed, Signed and Approved	28-02-17	28-02-17		28-02-17	31-03-17
9	Final Report to ONCAT	15-03-17	15-03-17		15-03-17	15-03-17

Appendix D – Risk Management

The following table below outlines the risks that were involved in the pathway project development:

Id.	Risk	Mitigation plan (what is being done to prevent the risk)	Contingency plan (what will be done if the risk occurs)	Likelihood of occurring	Potential impact (dollar / schedule / quality etc.)
1	Loss of key project personnel		More than one individual involved where possible to maintain continuity	Low	Would impact the schedule

Appendix E – Course Delivery Mode Recommendations

Mechanical Principles Bridge – February 17, 2017
Delivery Modes: Course Learning Outcomes / Course Objectives

12) Establish and maintain safe work environment, habits, and procedures.

- 12.1 Explain the necessary elements of safe work and a safe work environment.
- 12.2 Describe how safe work habits are gained and maintained.
- 12.3 Explain the purpose of plant safety programs, and typical structure.
- 12.4 Describe the role of Health and Safety committee member from a maintenance employee perspective.
- 12.5 Explain how safe work procedures are created, and the importance of following them in every situation.

MODE: Online Lecture materials, Video links to safety videos as required, online quizzes for practice

13) Interpret mechanical documents in preparation for Electromechanical tasks.

- 13.1 Read charts, tables, codes, standards, and other resource materials to extract usable data.
- 13.2 Read and interpret orthographic projections, Multiview projections, and auxiliary views of machine components.
- 13.3 Read and interpret assembly and detail drawings of machine components including bills of material.
- 13.4 State the principles of geometric tolerancing and symbols.
- 13.5 Read and interpret basic weld symbols.
- 13.6 Read and interpret pneumatic and hydraulic component symbols in both ANSI and ISO systems.

MODE: Online Lecture materials, reference materials either online or in text that includes symbols introduction for mechanical systems, views, welds, and pneumatic and hydraulic components

14) Define and calculate parameters required for mechanical tasks utilizing necessary principles of Applied Science.

- 14.1 State the basic principles of friction and stresses in machine parts with a non-mathematical approach.
- 14.2 Calculate belt, chain, and gear drive speeds and speed ratios given the geometry of the system.
- 14.3 Discuss, describe and/or identify various physical scientific properties and relate them to practical applications.
- 14.4 Solve, analyze and summarize analytical and non-analytical problems involving velocity and acceleration, heat and energy, fluid power and hydraulics.

MODE: Online Lecture materials, sample problems, online quizzes for practice

15) Describe the purpose for, and explain the operation of typical mechanical components found in machinery.

15.1 Explain the parts and application of the common types of journal and rolling-element bearings, including the necessary seals where applicable.

15.2 Explain the basic operation of gear drives, belt drives, chain drives including couplings, clutches, and brake systems.

15.3 Describe lubrication systems, standard oils and greases, and methods of lubrication.

MODE: Online Lecture materials, Video and photo links to show a variety of parts, drives, and lubrication systems, online quizzes for practice. Text materials are the Alberta Learn modules that introduces this material

16) Explain the purpose for, and components of various electromechanical systems.

16.1 Describe and apply the basic principles, terms, applications and safety procedures pertaining to pneumatic, hydraulic and fluid systems.

16.2 Describe fundamentals of industrial hydraulics and the standard components.

16.3 Describe the components and purpose of various types of equipment including; pumps, compressors and fans, stationary engines, conveyors, vessels and heat exchangers, furnaces and boilers.

MODE: Online Lecture materials, Video and photo links to show a variety of systems and assemblies, online quizzes for practice. Text materials are the Alberta Learn modules that introduces this materials.

17) Describe the most common maintenance programs used in industry and identify the benefits and weaknesses of each.

17.1 Describe/identify the various characteristics, measurements and analysis techniques with respect to commonly used maintenance practices.

MODE: Online Lecture materials that outlines common maintenance programs, online quizzes for practice

Mechanical Practices Bridge – February 17, 2017
Delivery Modes: Course Learning Outcomes / Course Objectives

18) Develop and maintain a safe work environment, habits and procedures.

18.1 Communicate effectively by means of verbal, written, and visual representation, about maintenance and machining operations and details.

18.2 Explain the necessary elements of safe work methods, and define a safe work environment.

18.3 Explain the necessary actions if something is deemed unsafe.

MODE: Online Lecture materials, Video links to safety videos as required, online quizzes for practice

19) Demonstrate proper basic mechanical maintenance skills following established procedures.

19.1 Demonstrate precision measurement within given standards in Imperial and Metric units.

19.2 Demonstrate skills in the use of hand and power tools commonly utilized in mechanical maintenance.

19.3 Perform standard lubrication procedures on mechanical equipment.

19.4 Diagnose operating problems with gear drives, belt drives, chain drives including couplings, clutches, and brake systems.

19.5 Assemble and disassemble mechanical systems using arbor press, hydraulic press, air tools, pullers, splitters, and slide hammers.

MODE: Online Lecture materials, 360-degree videos to be developed – skills and tools are identified and demonstrated – students interact with video later to show knowledge. Suggested videos to develop are:

a) Use of mechanical measurement tools
b) Care and use of standard mechanical hand tools
c) Care and use of standard mechanical power tools
d) Basic diagnosis, disassembly, repair and assembly of drives and auxiliaries

PART A – one day of two-day practical assessment at host college (7 hours)

20) Demonstrate proper basic skills utilizing machines found in the typical machine shop.

20.1 Select and apply the appropriate procedures, materials, and tools, for altering or producing mechanical components.

20.2 Correctly operate machine shop equipment to create part geometry to given tolerances and surface conditions.

20.3 Sketch assembly and component parts using orthographic, isometric and sectional views with relevant dimensions and notes.

MODE: Online Lecture materials, 360 Videos to be developed – skills and machines are identified and demonstrated – students interact with video later to show knowledge. Suggested videos to develop are:

a) Basic use of a metal lathe
b) Simple part machining with a metal lathe
c) Basic use of a milling machine
d) Simple part machining with a milling machine

PART B – second day of two-day practical assessment at host college (7 hours)

21) Troubleshoot and repair electro-mechanical equipment following accepted safety and maintenance procedures.

21.1 Perform standard maintenance tests on mechanical power transmission systems.

21.2 Perform measurement and analysis techniques utilized in commonly used maintenance practices.

MODE: Online Lecture materials, 360 Video to be developed – maintenance practices are identified and demonstrated – students interact with video later to show knowledge. Suggested video to develop:

a) Standard maintenance tests and measurements on a power transmission system

22) Demonstrate the ability to work as part of a team to safely perform shop exercises following written and verbal instructions.

22.1 Follow maintenance procedures and safety protocols to perform specified tasks.

MODE: Online Lecture materials, 360 Videos to be developed – how to identify safety issues and specify corrective action. Suggest video to develop:

a) Investigation of a system for safety issues, and what recommendations to address