



## COURSE OUTLINE: ELR211 - FLUIDS & COMBUSTION

Prepared: Randy Clouthier

Approved: Corey Meunier, Chair, Technology and Skilled Trades

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| <b>Course Code: Title</b>                                             | ELR211: FLUIDS & COMBUSTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Program Number: Name</b>                                           | 4104: INST CONTROL ENG TN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Department:</b>                                                    | ELECT./INSTRUMENTATION PS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Semesters/Terms:</b>                                               | 20F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Course Description:</b>                                            | This course includes the study of viscosity, pressure, temperature, gas laws, pressure at a depth, manometry, continuity equation, Bernoulli's equation, pitot tubes, orifice and venturi meters, laminar and turbulent flow, combustion and properties of steam.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Total Credits:</b>                                                 | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Hours/Week:</b>                                                    | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Total Hours:</b>                                                   | 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Prerequisites:</b>                                                 | There are no pre-requisites for this course.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Corequisites:</b>                                                  | There are no co-requisites for this course.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Essential Employability Skills (EES) addressed in this course:</b> | <div><div>EES 1</div><div>Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience.</div></div> <div><div>EES 2</div><div>Respond to written, spoken, or visual messages in a manner that ensures effective communication.</div></div> <div><div>EES 3</div><div>Execute mathematical operations accurately.</div></div> <div><div>EES 4</div><div>Apply a systematic approach to solve problems.</div></div> <div><div>EES 5</div><div>Use a variety of thinking skills to anticipate and solve problems.</div></div> <div><div>EES 6</div><div>Locate, select, organize, and document information using appropriate technology and information systems.</div></div> <div><div>EES 7</div><div>Analyze, evaluate, and apply relevant information from a variety of sources.</div></div> <div><div>EES 8</div><div>Show respect for the diverse opinions, values, belief systems, and contributions of others.</div></div> <div><div>EES 9</div><div>Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.</div></div> <div><div>EES 10</div><div>Manage the use of time and other resources to complete projects.</div></div> <div><div>EES 11</div><div>Take responsibility for one's own actions, decisions, and consequences.</div></div> |
| <b>Course Evaluation:</b>                                             | <div>Passing Grade: 50%, D</div> <div>A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Other Course Evaluation &amp; Assessment Requirements:</b>         | <div>Grade</div> <div>Definition Grade Point Equivalent</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

In response to public health requirements pertaining to the COVID19 pandemic, course delivery and assessment traditionally delivered in-class, may occur remotely either in whole or in part in the 2020-2021 academic year.



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A+ 90 - 100% 4.00  
 A 80 - 89%  
 B 70 - 79% 3.00  
 C 60 - 69% 2.00  
 D 50 - 59% 1.00  
 F (Fail) 49% and below 0.00

CR (Credit) Credit for diploma requirements has been awarded.  
 S Satisfactory achievement in field /clinical placement or non-graded subject area.  
 U Unsatisfactory achievement in field/clinical placement or non-graded subject area.  
 X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.  
 NR Grade not reported to Registrar's office.  
 W Student has withdrawn from the course without academic penalty.

**Course Outcomes and Learning Objectives:**

| Course Outcome 1                                                                      | Learning Objectives for Course Outcome 1                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Define, express and relate the properties of fluids                                   | Define the terms fluids and fluid mechanics<br>- Derive units of force, energy and pressure in SI and English<br>- Perform unit conversions<br>- Select the appropriate significant figures<br>- Define the tem density, weight density and specific gravity<br>- Derive the relationship between mass density and weight density<br>- Express pressure as equivalent liquid column<br>- Differentiate between gauge pressure and absolute pressure<br>- Explain the role of viscosity in fluid flow |
| Course Outcome 2                                                                      | Learning Objectives for Course Outcome 2                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Describe the behavior of fluids at rest                                               | Discuss the different forms of fluid energy<br>- Express the fluid energy as head<br>- Derive the relationships between pressure and elevation<br>- Measure fluid pressure using manometers and gauges<br>- Calculate the forces acting on retaining walls and buoyant forces on bodies immersed in fluids                                                                                                                                                                                           |
| Course Outcome 3                                                                      | Learning Objectives for Course Outcome 3                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Apply the principles of mass conservation and energy conservation to fluids in motion | Derive and apply continuity equation to size the pipes<br>- Apply the concept of energy conversation to write Bernoulli's equation<br>- Recognize the limitations of Bernoulli's equation<br>- Define Toricelli's theorem<br>- Describe the working principles of variable head meters                                                                                                                                                                                                               |
| Course Outcome 4                                                                      | Learning Objectives for Course Outcome 4                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Apply the principles of fluid mechanics to flow measurement                           | Identify hydraulic mechanics like pumps and turbines<br>- Expand Bernoulli's equation to include the terms head added and head lost apply energy equation to solve practical problems<br>- Calculate the power required to drive pumps<br>- Derive general flow equation for variable head meter<br>- Study a venturi meter in the laboratory<br>- Calculate the velocity of flow using Pitot-static tube                                                                                            |

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|                                               |                                                                                                                                                                                                              | <ul style="list-style-type: none"><li>- Characterize laminar flow and turbulent flow</li><li>- Compute frictional head loss</li><li>- Calculate total losses and use this in the general energy equation</li></ul>                                                  |                   |                         |     |      |     |               |     |  |
|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------|-----|------|-----|---------------|-----|--|
|                                               | <b>Course Outcome 5</b>                                                                                                                                                                                      | <b>Learning Objectives for Course Outcome 5</b>                                                                                                                                                                                                                     |                   |                         |     |      |     |               |     |  |
|                                               | Describe the Products of Combustion                                                                                                                                                                          | Define Combustion and its properties <ul style="list-style-type: none"><li>- Fuels</li><li>- Molecular structure of fuels</li><li>- Write balanced Combustion equations</li><li>- Describe Stoichiometric Ratio</li><li>- Describe heating Value of Fuels</li></ul> |                   |                         |     |      |     |               |     |  |
|                                               | <b>Course Outcome 6</b>                                                                                                                                                                                      | <b>Learning Objectives for Course Outcome 6</b>                                                                                                                                                                                                                     |                   |                         |     |      |     |               |     |  |
|                                               | Describe Flue gases and Flue gases Analyses                                                                                                                                                                  | Describe the products of Combustion <ul style="list-style-type: none"><li>- Boiler efficiency and Excess Air</li></ul>                                                                                                                                              |                   |                         |     |      |     |               |     |  |
| <b>Evaluation Process and Grading System:</b> | <table><tr><th>Evaluation Type</th><th>Evaluation Weight</th></tr><tr><td>Assingments and quizzes</td><td>10%</td></tr><tr><td>Labs</td><td>20%</td></tr><tr><td>Written Tests</td><td>70%</td></tr></table> | Evaluation Type                                                                                                                                                                                                                                                     | Evaluation Weight | Assingments and quizzes | 10% | Labs | 20% | Written Tests | 70% |  |
|                                               | Evaluation Type                                                                                                                                                                                              | Evaluation Weight                                                                                                                                                                                                                                                   |                   |                         |     |      |     |               |     |  |
|                                               | Assingments and quizzes                                                                                                                                                                                      | 10%                                                                                                                                                                                                                                                                 |                   |                         |     |      |     |               |     |  |
|                                               | Labs                                                                                                                                                                                                         | 20%                                                                                                                                                                                                                                                                 |                   |                         |     |      |     |               |     |  |
| Written Tests                                 | 70%                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                     |                   |                         |     |      |     |               |     |  |
| <b>Date:</b>                                  | September 2, 2020                                                                                                                                                                                            |                                                                                                                                                                                                                                                                     |                   |                         |     |      |     |               |     |  |
| <b>Addendum:</b>                              | Please refer to the course outline addendum on the Learning Management System for further information.                                                                                                       |                                                                                                                                                                                                                                                                     |                   |                         |     |      |     |               |     |  |

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