MCT 4180
Fluid Mechanics

Course Description:
Properties of fluids, fundamentals of fluid flow, Pressure measurement and manometers, Principles of buoyancy, Application of continuity and momentum equations, Energy equation and quantifying loses in a piping system, Principles of Drag and Lift, Pipe systems in series and parallel, Pump selection, Dimensional analysis and similitude, Open channel flows.

Credit Hours:
3 Credit Hours (Lect: 3; Lab: 1).

Prerequisite(s):
ET 3030.

Co-requisite(s):
ET 3450.

Textbook(s) Required:

Course Objectives:
Upon successful completion of this the student will be able to:

1. Determine the fluid properties and apply them to solve the fluid mechanics problems [SO b, d, f]
2. Compute the resulting force exerted on submerged plane and curved areas by a static liquid. [SO b, d, f]
3. Use the principal of static equilibrium to solve for the forces involved in buoyancy problems. [SO b, d, f]
4. Define the relationship between absolute, gage, and atmospheric pressures. [SO b, d, f]
5. Define steady flow and the principle of continuity; write the continuity equation. [SO b, d, f]
6. Apply Bernoulli’s equation to fluid flow system. [SO b, d, f]
7. Apply the general energy equation to a variety of practical problems. [SO b, d, f]
8. Describe the appearance of laminar and turbulent flows and compute the Reynolds number for various cases of fluid flow. [SO b, d, f]
9. Determine the friction factor; use the Darcy-Weibach equations for computing energy losses due to friction. [SO b, d, f]
10. Identify series pipe line system and determine whether a given system is Class I, Class II, or Class III; use the appropriate Class to solve various pipe flow problems. [SO b, d, f]
11. Calculate loss coefficients for different valves and fittings. Also calculate loss coefficients from lab data. [SO b, d, f]
12. Identify the proper selection and application of pumps, their performance characteristics and typical uses. [SO b, d, f]
13. Define the net positive suction head (NPSH) for a pump. [SO b, d, f]
14. Describe the performance of pumps connected in parallel and series. [SO b, d, f]
15. Define the specific speed for a centrifugal pump. [SO b, d, f]
16. Calculate Drag and Lift force. Read Coefficient of Drag and Lift from charts and tables. [SO b, d, f]
17. Identify non dimensional parameters (PI groupings) by performing dimensional analysis. [SO b, d, f]
18. Calculate hydraulic radius and flow rates and velocities for open channel flows. [SO b, d, f]
19. Use the oral presentation of the laboratory work as an evidence of the ability to verbally communicate concisely, conclusively, and effectively. [SO b, d, f, g]

Topics Covered:
1. Introduction.
2. Fluid properties, Specific gravity, Specific weight, Viscosity, Newtonian and Non Newtonian Fluids.
3. Equations of fluid statics and pressure measurement.
4. Manometers, pressure on plan areas.
5. Forces on curved areas, buoyant force.
6. Flow characteristics, control volume, continuity equations.
7. Euler’s and Bernoulli’s equations, losses and energy equations.
10. Laminar and turbulent flows.
11. Turbulent flow, steady flow in channels, pipes, losses.
12. Drag, lift, fluid measurements, rate devices, measurements.
13. Specific speed, turbo machines, Pumps, turbines, compressor and cavitation.

Laboratory:

1. Lab class 1 – Fluid Properties. [SO c, g]
2. Lab class 2 – Impact of Jets. [SO c, g]
3. Lab class 3 – Venturi Meter [SO c, g]
4. Lab class 4 – Losses through bends and pipes. [SO c, g]
5. Lab class 5 - Developing an Excel sheet to solve pipe problems. [SO c, g]
6. Lab class 6 - Fluid Mechanics Films [SO c, g]
7. Lab class 7 – CFD Demonstration [SO a]

Contributions to MCT Student Outcomes:

<table>
<thead>
<tr>
<th>Level</th>
<th>BSMCT Program Student Outcomes</th>
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<tr>
<td>2</td>
<td>a. an ability to select and apply the knowledge, techniques, skills, and modern tools of their disciplines to broadly-defined engineering technology activities</td>
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<tr>
<td>2</td>
<td>b. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies</td>
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<tr>
<td>2</td>
<td>c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes</td>
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<td>2</td>
<td>d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives</td>
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<td>1</td>
<td>e. an ability to function effectively as a member or leader on a technical team</td>
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<td>3</td>
<td>f. an ability to identify, analyze, and solve broadly-defined engineering technology problems</td>
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<td>2</td>
<td>g. an ability to communicate effectively regarding broadly-defined engineering technology activities</td>
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<td>h. an understanding of the need for and an ability to engage in self-directed continuing professional development</td>
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<td>i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity</td>
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<td>j. a knowledge of the impact of engineering technology solutions in a societal and global context</td>
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<td>k. a commitment to quality, timeliness, and continuous improvement</td>
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### M1 – MCT Design Track:

Students in this track will demonstrate the ability to apply principles of materials and mechanics to the design and analysis of mechanical components and mechanisms.

### M2 – MCT Energy Track:

Students in this track will demonstrate the ability to apply principles of thermo-fluid sciences to the design and analysis of energy systems.

### M3 – MCT Manufacturing Track:

Students in this track will demonstrate the ability to apply principles of materials and production techniques to the planning, implementation, and control of manufacturing processes.

### Grading Scale:

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<th>Grade</th>
<th>Percentage Range</th>
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<tr>
<td>A</td>
<td>95-100</td>
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<tr>
<td>A-</td>
<td>90-94</td>
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<td>B+</td>
<td>87-89</td>
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<td>B</td>
<td>83-86</td>
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<tr>
<td>B-</td>
<td>80-82</td>
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<td>C+</td>
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<td>C</td>
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<td>D</td>
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<td>D-</td>
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<td>E</td>
<td>Below 60</td>
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### Withdrawal Policy:

- Last day to drop with a tuition refund: End of 2nd Week of Semester
- Last day to drop without a notation of W on the transcript: End of 4th Week
- Final day to drop with W (ET Students): End of 8th Week

All drop/add activity during the first four weeks should be done by the student through Pipeline. Withdrawal after the fourth week requires the instructor's permission and must be submitted on a Drop/Add form to the Registrar's Office. Withdrawal after the ‘final drop’ date will only be permitted under exceptional circumstances and requires the permission of the Chair of the ET Division. A failing grade is not an acceptable reason for withdrawal after the ‘final drop’ date.

### Policy on Cheating:

Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure Academic Integrity, will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course and may be subject to additional penalties.

### University / Department Policies:

- Academic Misconduct
  [http://www.et.eng.wayne.edu/et/academicmisconduct/academicmisconduct.html](http://www.et.eng.wayne.edu/et/academicmisconduct/academicmisconduct.html)
- Withdrawal from Engineering Tech classes
- Deferred Grades
Code of Ethics for Engineers:
http://cems.alfred.edu/courses/ces120/ethics/abet.html
http://cems.alfred.edu/courses/ces120/ethics/ieee.html
http://onlineethics.org/codes/
http://www.iit.edu/departments/csep/codes/coe/abet-a.html

Prepared by: