Department of Industrial Engineering and Management

Course Outline

ME 3111

Fluid Mechanics and Machinery

Year 2019 Term 1

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**Khulna University of Engineering and Technology**

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# About this course

|  |  |  |  |
| --- | --- | --- | --- |
| Course Code: | ME 3111 | Credit point: | 3.00 |
| Course Title: | Fluid Mechanics and Machinery | Year and Term | 2019, Term 1 |

# Key Teaching Staff

|  |  |  |
| --- | --- | --- |
| Teacher 1 (Unit Coordinator) | Teacher 2 | Teaching Assistant |
| Contact details of Teacher 1 | Contact details of Teacher 2 | Contact details of TA |

# Teaching Details

|  |  |  |
| --- | --- | --- |
| Lecture 1: | : Mon 8.50 – 9.40 am | Teacher 1 (W1 – W13) |
| Lecture 2: | : Tues 10.40 – 11.30 am | Teacher 2 (W1 – W13) |
| Lecture 3: | : Thurs 8.50 – 9.40 am | Teacher 1 (W1 – W6), Teacher 2 (W7 – W13) |

# Pre-requisites/Co-requisites

Math 1111 (Prerequisite)

No Corequisite

# Mode of delivery

Face to face

# Course Description/Rationale

Fluid Mechanics deals with the study of the properties and movement of liquids and gases. Fluids are found and used in every facet of our lives, ranging from the water we are so much dependent on to complex hydraulic machines. The history of fluid mechanics is as old as civilisation itself, as water has been used for centuries for irrigation, power, navigation, and so on. This course aims to provide students with a strong understanding of the basic concepts of fluid mechanics, which is essential for most engineering disciplines. It would introduce and teach students numerous concepts in static fluids as well as fluids in motion. Most of these concepts would be taught using practical examples found in day-to-day life (e.g. objects immersed in water, water flowing in garden hoses and pipes, pumps, etc). Practical lab experiments would be undertaken to explain these concepts using hands-on experiments and demonstrations.

# Course Topics

Fluid properties; Pressure measurement.

**Fluid statics:** Force on submerges planes and curved surfaces;

**Fluid Dynamics**: Continuity equations, Euler equation, Energy equation, Bernoulli equation, Different flow measuring devices, Impulse momentum equation, Pipe flow, Frictional losses in pipes and fittings (Moody diagram), Dimensional analysis and similitude

**Fluid Machinery**: Centrifugal pumps, Introduction to radial and axial flow pumps, Reciprocating pumps, Cavitation’s, Introduction to impulse and reaction turbines, Compressor

# Intended Learning Outcomes (ILO)

On successful completion of the courses, students should be able to –

1. Apply basic concepts of Fluid Mechanics (hydrostatics as well as hydrodynamics), complemented with practical laboratory-based experiments;
2. Calculate hydrostatic force on submerged bodies;
3. Evaluate the factors that control the stability of floating bodies;
4. Use continuity, momentum and energy equations to solve problems related to pipes and inter-reservoir pipe flow;
5. Identify types of pumps and select suitable pumps for a variety of situations; and
6. Distinguish various types of turbines, and their working principles.

# Learning and Teaching Strategy

Theoretical concept will be delivered and reinforced by problem solving in the lecture. In addition, small group teaching will be organised to facilitate problem- based learning as tutorial class format. The practical demonstration of the theories will be carried in the sessional course ME 3112

# Graduate Capabilities/Profiles (GC)

In addition to discipline knowledge, skills and their application, the student experience within this course contributes to students developing the capabilities needed to be

GC 6.1.1: **Engineering knowledge**: Apply the knowledge of mathematics, science engineering fundamentals and an engineering specialization to the solution of complex engineering problems

GC 6.1.2. **Problem analysis**: Identify, formulate, research and analyse complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences

GC 6.1.3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns

GC 6.1.7. **Environment and sustainability**: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development

# Relationship to Professional Accreditation Requirements

The course satisfied following BAETE (according to ABET) competencies requirements

6.2.1. An ability to apply knowledge of mathematics, science and engineering.

6.2.5. An ability to identify, formulate and solve engineering problems

6.2.3. An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environment, social, political, ethical, health and safety, manufacturability and sustainability

# Required Reading and Support Materials

1. Fluid Mechanics, Frank M White, 11th Edition, McGraw Hill, 2018
2. Lecture Notes
3. Fluid Mechanics: Fundamentals and Applications, John Cimbala and Yungus A. Cengel

# Assessment Details

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sl | Assessment Task | ILOs | Weighting | Tentative Week |
| 1 | Class Participation/Spot Test | ILO 2, 4 | 10% | W1-W13 |
| 2 | Class Tests (3 – 4 tests) | ILO 2, 3, 4 | 20% | W4, W6, W8, W11 |
| 3 | Assignments | ILO 1 | Ungraded | W2, W13 |
| 4 | End of Semester Exam | ILO 1 – 6 | 70% | W15 |

# Assessment Notes

* Class tests will be based on materials covered by respective teacher till test date.
* End of semester exam will be a 3-hour written exam covering all contents in the course.
* Spot test will be instantaneously conducted by the teacher based on class topic.
* Assignments will be given to practice problems related to theory covered in the class. It is ungraded; however, it can be used to augment student performance in the tests.

# Examinations

Examination guideline will be provided during the exams

# Special Considerations

Special consideration in the event of an unforeseen circumstances to organize class test and final exam in a time other than the scheduled. Assignments can be exempted or given extension for such case. However, for all such case, application must be made in advance with approval from the head of the department with appropriate evidence.

# Late Submission

Late submission of assignments will attract a penalty of 5% of the available assignment mark per day. Assignments more than 10 days late will normally not be accepted and be assigned a mark of 0.

# Indicative Course Delivery Schedule

**Model 1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Wk | Topics (Mon)  (Teacher 1) | Topics (Tue)  (Teacher 1/ Teacher 2) | Topics (Thurs)  (Teacher 2) | CLO | Teaching/ Learning/ Assessment Strategy | Book/ Resource Reference |
| 1 | Properties of Fluid - Definition | Properties of Fluid – Problem solving | Centrifugal Pumps – Introduction, Types, Functions/ principles |  |  | B1(1.3 - 1.6)  B1(9.3, 9.7) |
| 2 | Pressure Measurement - Definitions | Pressure Measurement – Problems (Assignment 1) | Centrifugal Pumps – Problem solving/Design |  |  | B1(2.1 – 2.5); B1(9.10– 9.12) |
| 3 | …. |  |  |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 4 | Class Test 1\*\* |  | Topic…..  (Assignment 2) |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 5 | Topic …  (Assignment 1 due) |  |  |  |  | B1(2.1 – 2.5); B1(9.10– 9.12) |
| 6 |  |  | Class Test 2\*\* |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 7 |  |  | Topic ……  (Assignment 2 due) |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 8 | Class Test 3\*\* |  |  |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 9 |  |  |  |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 10 |  |  |  |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 11 |  |  | Class test 4\*\* |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 12 |  |  |  |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 13 |  |  |  |  |  | B1(1.3 – 1.6); B1(9.3 – 9.7) |
| 15 | End of Term Final Exam | | |  |  |  |

**Model 2**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Wk | Topics (Mon)  (Teacher 1) | CLO | \*T/ L/ A Strategy | Resource Reference | Topics (Tue)  (T1/ Teacher 2) | CLO | T/ L/ A Strategy | Resource Reference | Topics (Thurs)  (Teacher 2) | CLO | T/ L/ A Strategy | Resource Reference |
| 1 | Properties of Fluid - Definition |  |  | B1(1.3 – 1.6); | Properties of Fluid – Problem solving |  |  | B1(1.3 - 1.6) | Centrifugal Pumps – Introduction, Types, Functions |  |  | B1(9.3 – 9.7) |
| 2 | Pressure Measurement - Definitions |  |  | B1(2.1 – 2.5); | Pressure Measurement – Problems (Assignment 1) |  |  | B1(2.1 – 2.5); | Centrifugal Pumps – Problem solving/Design |  |  | B1(9.10– 9.12) |
| 3 | …. |  |  | B1(1.3, 1.6); |  |  |  | B1(1.3,1.6); |  |  |  | B1(9.3 – 9.7) |
| 4 | Class Test 1\*\* |  |  |  |  |  |  | B1(1.3 – 1.6); | Topic…..  (Assignment 2) |  |  | B1(9.3 – 9.7) |
| 5 | Topic …  (Assignment 1 due) |  |  | B1(2.1 – 2.5); |  |  |  | B1(9.10– 9.12) |  |  |  | B1(9.10– 9.12) |
| 6 |  |  |  | B1(1.3 – 1.6); |  |  |  | B1(9.3 – 9.7) | Class Test 2\*\* |  |  | B1(9.3 – 9.7) |
| 7 |  |  |  | B1(1.3 – 1.6); |  |  |  | B1(9.3 – 9.7) | (Assignment 2 due) |  |  |  |
| 8 | Class Test 3\*\* |  |  | B1(1.3 – 1.6); |  |  |  | B1(9.3 – 9.7) |  |  |  | B1(9.3 – 9.7) |
| 9 |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |  |  | Class test 4\*\* |  |  |  |
| 12 |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |  |  |  |  |  |  |

\*\*Subject to change \*T/ L/ A – Teaching/Learning/Assessment