**University**: Misr University for Science & Technology

**Faculty**: Faculty of Engineering Science and Technology

**Department offering the program**: Mechanical Engineering Department

**Department offering the course**: Mechanical Engineering Program

**1- Course Data (Basic Information)**

**Course Code & Title:** ME 312: Fluid Mechanics 3  **Semester/Year:** First / 2023-2024

**Prerequisite Course(s):** GE105,MATH202, ME211 **Core or Elective:** Core Course

**Credit Hours:** 3 **Weekly Contact Hours**: **Lecture:** 2 **Tutorial:** 2 **Laboratory:** 0

**2- Course Aims**

The students should understand the fundamental’s principles of fluid mechanics, where the basic concepts of mass conservation are introduced and the fundamental energy equations and relations (such as the differential momentum and the Reynolds analogy) are developed. Also, this course presents a number of examples and problems that occur in some heat transfer equipment.

**3- Course Contents** (As indicated in the program Bylaw)

Fundamental concepts Properties of fluids and fluid statics. Fluid kinematics and Reynold's transport theorem. Bernoulli and energy equations with applications. Linear and angular momentum equations with applications. Internal flows. laminar and turbulent flows. Head loss and friction factor. Flow measurement.

**4- Program Competences Served by The Course (A2, B4 and C1)**

**Level (A) Engineering Competences**

**A.1** Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics**.**

**A.8** Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tool**s.**

**Level (B) Mechanical Engineering Competences**

**B.1** Model, analyse and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations

**5- Learning Outcomes (LO’s)**

*At the end of the course, the student will be able to:*

|  |  |
| --- | --- |
| Cognitive Domain | |
| LO1 | Define the basic properties of fluids and understand the continuum approximation. |
| LO2 | Understand the use and limitations of the Bernoulli’s equation and the various kinds of forces and moments acting on a control volume. |
| LO3 | Determine the variation of pressure inside fluid at rest. |
| LO4 | Analyze the rigid body motion of the fluids in containers during linear acceleration. |
| LO5 | Apply the mass equation to balance the incoming and outgoing flow rates in a flow system. |
| LO6 | Apply Bernoulli’s equation to solve a variety of fluid flow problems. |
| LO7 | Use control volume analysis to determine the forces and moments associated with fluid flow. |
| LO8 | Calculate the major and minor losses associated with pipe flow in piping networks and determine the pumping power requirements. |

**6- Mapping Learning Outcomes (LO’s) with Competences**

|  |  |  |  |
| --- | --- | --- | --- |
| **LO’s NARS** | **A1** | **A8** | **B1** |
| Cognitive Domain | | | |
| LO1 | ◼ |  |  |
| LO2 | ◼ |  |  |
| LO3 |  | ◼ |  |
| LO4 |  |  | ◼ |
| LO5 |  |  | ◼ |
| LO6 |  |  | ◼ |
| LO7 | ◼ |  |  |
| LO8 |  | ◼ |  |

**7- Lecture Plan**

1. Topics to be Covered weekly & Matrix of LO’s

| Week | Topics | Planned Hours | Learning Outcomes | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LO1 | LO2 | LO3 | LO4 | LO5 | LO6 | LO7 | LO8 |
| W1 | Fluid Properties | **4** | ◼ |  |  |  |  |  |  |  |
| W2 | Surface tension | **4** | ◼ |  |  |  |  |  |  |  |
| W3 | Pressure determination inside static fluid | **4** |  |  | ◼ |  |  |  |  |  |
| W4 | Pressure variation due to fluid motion as a single body | **4** |  |  | ◼ | ◼ |  |  |  |  |
| W5 | Fluid forces on submerged bodies | **4** |  |  | ◼ |  |  |  |  |  |
| W6 | Fluid kinematics and differential form of continuity equation | **4** |  |  |  |  | ◼ |  |  |  |
| W7 | Reynolds transport theorem and integral form of continuity equation. | **4** |  |  |  |  | ◼ |  |  |  |
| W8 | Rate of change of fluid momentum applications | **4** |  |  |  |  | ◼ |  |  |  |
| W9 | Rate of change of fluid moment of momentum applications | **4** |  |  |  |  | ◼ |  | ◼ |  |
| W10 | Derivation of Bernoulli’s equation | **4** |  | ◼ |  |  |  |  |  |  |
| W11 | Applications of Bernoulli’s equation | **4** |  |  |  |  |  | ◼ |  |  |
| W12 | Friction losses determination inside pipes | **4** |  |  |  |  |  |  |  | ◼ |
| W13 | Moody chart usage and pumping power determination | **4** |  |  |  |  |  |  |  | ◼ |
| W14 | Dimensionless analysis | **4** | ◼ |  |  |  |  |  |  |  |
| W15 | Revision | **4** |  |  |  |  |  |  |  |  |
| W16 | Exam | **4** |  |  |  |  |  |  |  |  |

1. Additional private study/learning hours expected for students per week is FOUR hours

**8) Teaching and Learning Methods**

| **Learning Outcomes** | | **Teaching and Learning Methods** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Face-to-face Lecture | Online Lectures | Tutorial / Exercise | Group Discussions | Laboratory | Self-Reading | Presentation | Collaborate Learning (Team Project) | Research and Reporting | Brain Storming |
| **Cognitive Domain** | LO1 | ⚫ | ⚫ | ⚫ |  |  |  |  |  |  |  |
| LO2 | ⚫ |  | ⚫ |  |  |  |  |  |  |  |
| LO3 | ⚫ | ⚫ | ⚫ |  |  |  |  |  |  |  |
| LO4 | ⚫ | ⚫ | ⚫ |  |  |  |  |  |  |  |
| LO5 | ⚫ |  | ⚫ | ⚫ |  |  |  |  |  |  |
| LO6 | ⚫ |  | ⚫ | ⚫ |  |  |  |  |  |  |
| LO7 | ⚫ | ⚫ | ⚫ |  |  |  |  |  |  | ⚫ |
| LO8 | ⚫ |  | ⚫ |  |  |  |  |  | ⚫ |  |

**Student Academic Counseling and Support**

* Students are directed to contact teaching staff for academic support during specific office hours.
* Regarding this course, Instructor and TA will be available two hours a week as indicated on the time table declared for students from the beginning of the semester.
* Social media communication such as Whatsapp groups, Microsoft teams chat, … etc

**9- Student Assessment**

**a) Student Assessment Methods**

| **Learning Outcomes** | | **Assessment Methods** | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Written Exams | Online Exams | Oral Exam | Pop Quizzes | In-class Problem Solving | Take-Home Exam | Research Assignments | Reporting Assignments | Project Assignments | In-class Questions |
| **Cognitive Domain** | LO1 | ⚫ |  |  |  |  |  |  |  |  | ⚫ |
| LO2 | ⚫ |  |  |  | ⚫ |  |  | ⚫ |  |  |
| LO3 | ⚫ |  |  | ⚫ |  |  |  |  |  | ⚫ |
| LO4 | ⚫ |  |  |  | ⚫ |  |  |  |  |  |
| LO5 |  |  |  |  |  |  | ⚫ |  |  | ⚫ |
| LO6 | ⚫ |  |  | ⚫ | ⚫ |  |  |  |  |  |
| LO7 | ⚫ |  |  |  |  |  | ⚫ |  |  | ⚫ |
| LO8 | ⚫ |  |  |  |  |  |  | ⚫ |  |  |

**b- Assessment Schedule and Weight**

|  |  |  |
| --- | --- | --- |
| **Assessment Tools** | **Week** | **Weight** |
| First Midterm Examination | 7 | 20 % |
| Second Midterm Examination | 12 | 20% |
| Final Examination | (As Scheduled) | 40 % |
| Quizzes (3 times) | 3, 5, 9 | 5 % |
| Home assignments | 3,4,5,8,10,11 | 10% |
| Matlab Mini Project | 8 | 5 % |
| **Total** |  | **100** % |

**10- Facilities**

The following facilities are needed for this course:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ■ | Classroom | □ | Smart Board | □ | Computer with software |
| □ | Lecture Hall | ■ | White Board | ■ | MIS system |
| □ | Sound and Microphone | ■ | Data Show | ■ | Internet Access |
| □ | Other: ………………… |  |  |  |  |

**11- List of References**

**a- Course Notes**

Lectures Notes in PDF

<https://bu.edu.eg/staff/mahmoudhassan3>

**b- Books**

1. Yunus A. Cengel and John M. Cimbala. “Fluid Mechanics Fundamentals and Applications”, 3rd edition, McGraw Hill Education., New York, 2018.

**c- Recommended Books**

1. Frank M. White. “Fluid Mechanics”, 8th edition, McGraw Hill Education, New York, 2016.

**- Course Coordinator: Dr. Mahmoud Ahmed Sharafeldin Signature:**

**- Program Coordinator: Signature:**