2023
TP-153

# Course Specification
(Bachelor)

| | |
|---|---|
| **Course Title:** | Fluid Mechanics |
| **Course Code:** | 331-MEC-3 |
| **Program:** | Bachelor of Science in Engineering |
| **Department:** | Mechanical Engineering |
| **College:** | College of Engineering |
| **Institution:** | Najran University |
| **Version:** | 1.0 |
| **Last Revision Date:** | 02/27/2024 |

## Table of Contents

## A. General information about the course:

### 1. Course Identification

| | | | | | |
|---|---|---|---|---|---|
| **1. Credit hours: 3** | | | | | |
| **2. Course type** | | | | | |
| **A.** | ☐University | ☐College | ☒ Department | ☐Track | ☐Others |
| **B.** | ☒ Required | | ☐Elective | | |
| **3. Level/year at which this course is offered: Fourth Year \ Level 7** | | | | | |
| **4. Course general Description:** | | | | | |

Definition and Properties of Fluids, Its Classification, Normal and Shear Stress in Fluids, Pressure at a Point, Basic Equation of Fluid Statics, Hydrostatic Forces on Submerged Bodies, Buoyancy and Stability. Kinematics of Fluid Flow: Types of Motions, Streamlines, Path lines, Streak lines, Velocity and Rotation, Stream Function, Vorticity and Circulation, Irrotational Flow, Velocity Potential Function. Dynamics of Ideal Fluid Flow: Euler's Equation, Bernoulli's Equation, Its Application to Different Types of Fluid Flow. Flow Measuring Devices, Venturi meter, Orifice Meter, Nozzle Meter, Pitot Static Tube, Hydraulic Coefficients. Flow Through Pipes, Major and Minor Losses in Pipes, Power Transmission by a Pipe Line

**5. Pre-requirements for this course** (if any)**:**

221-MEC-3(Thermodynamics1)

**6. Co-requisites for this course** (if any)**:**

NIL

**7. Course Main Objective(s):**

1. Explain the basic concepts of fluid mechanics and recognize the various types of fluid flow problems encountered in practice, the continuum assumption and the no- slip condition.
2. Apply the fluid statics principles to calculate the pressure variation in a static fluid and calculate the forces exerted on plane and curved surfaces, and understand applications of manometers and other pressure-measuring devices.
3. Apply Bernoulli equation to different types of flow problems and understand the limitations of this equation.

4 Demonstrate a basic understanding of fluid flow kinematics and the Eulerian/ Lagrangian descriptions of fluid flow.
5. Apply the Buckingham Pi theorem and recognize the importance of dimensional analysis in fluid mechanics.

## 2. Teaching mode (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|---|---|---|---|
| 1 | Traditional classroom | 60 | 100% |
| 2 | E-learning | | |
| 3 | Hybrid<br>• Traditional classroom<br>• E-learning | | |
| 4 | Distance learning | | |

## 3. Contact Hours (based on the academic semester)

| No | Activity | Contact Hours |
|---|---|---|
| 1. | **Lectures** | 30 |
| 2. | **Laboratory/Studio** | 15 |
| 3. | **Field** | |
| 4. | **Tutorial** | 15 |
| 5. | **Others (specify)** | |
| **Total** | | 60 |

## B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| **1.0** | **Knowledge and understanding** | | | |
| 1.1 | **Contributes primarily to the students' knowledge of engineering topics, but does not** | **1** | **TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based** | **-Test performance evaluation -Evaluation of participation in discussion and** |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| | provide design experience. | | learning through tutorials<br>TS: 3 – Associating the topics in each chapter with the CLO.<br>TS:4 – Conducting quizzes from each chapter<br>TS:5 – Giving more example programs in the lecture<br>TS: 6 – Discussion with the students in the class hours | group assignments |
| 1.2 | Develop the necessary skills to deal with fluid mechanics and its applications. | 7 | TS:1-Interactive lectures using PowerPoint slides<br>TS:2- Engaging the students in problem-based learning through tutorials<br>TS: 3 – Associating the topics in each chapter with the CLO.<br>TS:4 – Giving more assignment from each chapter<br>TS:5 – Giving more example programs in the lecture<br>TS: 6 – Discussion with the students in the class hours | -Test performance evaluation<br>-Evaluation of participation in discussion and group assignments |
| ... | | | | |
| 2.0 | Skills | | | |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| 2.1 | Illustrate difference methods for problems solving, reasoning for each problem solved | 6 | TS:1-Interactive lectures using PowerPoint slides<br>TS:2- Engaging the students in problem-based learning through tutorials<br>TS: 3 – Associating the topics in each chapter with the CLO.<br>TS:4 – Conducting quizzes from each chapter<br>TS: 5 – Discussion with the students in the class hours | •Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics<br>•Assignments involving critical and logical thinking questions<br>•Quizzes |
| 2.2 | | | | |
| ... | | | | |
| **3.0** | **Values, autonomy, and responsibility** | | | |
| 3.1 | Solve the problem by asking questions during the office hour. | 5 | TS:1-Interactive lectures using PowerPoint slides<br>TS:2- Engaging the students in problem-based learning through tutorials<br>TS: 3 – Associating the topics in each chapter with the CLO.<br>TS:4 – Conducting midterm and Final Exam from each chapter | Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics<br>•Assignments involving critical and logical thinking questions<br>•Quizzes |

| Code | Course Learning Outcomes | Code of CLOs aligned with program | Teaching Strategies | Assessment Methods |
|---|---|---|---|---|
| | | | TS:5 – Giving more example programs in the lecture<br>TS: 6 – Discussion with the students in the class hours | |
| 3.2 | Tell opinion and justify of communicating in Teams | 4 | TS:1-Interactive lectures using PowerPoint slides<br>TS:2- Engaging the students in problem-based learning through tutorials<br>TS: 3 – Associating the topics in each chapter with the CLO.<br>TS:4 – Conducting midterm and Final Exam from each chapter<br>TS:5 – Giving more example programs in the lecture<br>TS: 6 – Discussion with the students in the class hours | Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics<br>•Assignments involving critical and logical thinking questions<br>•Quizzes |
| ... | | | | |

## C. Course Content

| No | List of Topics | Contact Hours |
|---|---|---|
| 1. | Concepts and definitions | 12 |
| 2. | Fluid statics. Forces on submerged surfaces and bodies. | 10 |
| 3. | Non-viscous flow, conservation of mass, momentum and energy. | 10 |
| 4. | Bernoulli equation and Dimensional analysis. | 50 |
| 5. | Viscous flow, pipe flow, losses in conduit flow. | 10 |
| 6. | Laminar and turbulent flow. | 8 |

| Total | 60 |
|---|---|

## D. Students Assessment Activities

| No | Assessment Activities * | Assessment timing (in week no) | Percentage of Total Assessment Score |
|---|---|---|---|
| 1. | Assignments | 1-10 | 10% |
| 2. | Quizzes | 1-10 | 10% |
| 3. | Mid-term | 4 & 8 | 20% |
| 4. | labs | 1-10 | 10% |
| 5. | Final exam | 15 | 50% |

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

## E. Learning Resources and Facilities

### 1. References and Learning Resources

| | |
|---|---|
| Essential References | "Fluid Mechanics, Fundamentals and Applications," 1st Ed, Yunus A. Çengel and John M. Cimbala, McGraw Hill higher Edu. 2005 |
| Supportive References | "Fluid Mechanics" 7th Ed, F. M. White, McGraw Hill, 2021 |
| Electronic Materials | Online custom books |
| Other Learning Materials | NA |

### 2. Required Facilities and equipment

| Items | Resources |
|---|---|
| **facilities** (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.) | Classrooms and laboratories |
| **Technology equipment** (projector, smart board, software) | -- |
| **Other equipment** (depending on the nature of the specialty) | -- |

## F. Assessment of Course Quality

| Assessment Areas/Issues | Assessor | Assessment Methods |
|---|---|---|
| Effectiveness of teaching | Program Leaders and Peer Reviewer | Direct, Indirect |
| Effectiveness of Students assessment | Students & Faculty | Direct and Indirect |
| Quality of learning resources | Students & Faculty | Direct and Indirect |
| The extent to which CLOs have been achieved | Students & Faculty | Direct and Indirect |
| Other | | |

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

## G. Specification Approval

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|---|---|
| COUNCIL /COMMITTEE | DEPARTMENT OF MECHANICAL ENGINEERING |
| REFERENCE NO. | |
| DATE | 02/27/2024 |