# MNE4122: INTRODUCTION TO MICROFLUIDICS

**Effective Term**
Semester A 2022/23

## Part I Course Overview

**Course Title**
Introduction to Microfluidics

**Subject Code**
MNE - Mechanical Engineering
**Course Number**
4122

**Academic Unit**
Mechanical Engineering (MNE)

**College/School**
College of Engineering (EG)

**Course Duration**
One Semester

**Credit Units**
3

**Level**
B1, B2, B3, B4 - Bachelor's Degree

**Medium of Instruction**
English

**Medium of Assessment**
English

**Prerequisites**
Nil

**Precursors**
Nil

**Equivalent Courses**
Nil

**Exclusive Courses**
Nil

## Part II Course Details

**Abstract**
Microfluidics technology has been matured into a multidisciplinary subject that profoundly impacts both scientific research and real-world products. This course covers an introduction to the fundamental concepts, manufacturing methods, basic

classifications, and practical applications of microfluidic systems. The course aims to equip students with knowledge of both fundamentals and applications of microfluidics, with deep insight on various microfluidic systems used for tackling key issues in multidisciplinary areas, and with skills in analysing and designing microfluidic systems for solving practical problems.

**Course Intended Learning Outcomes (CILOs)**

| | CILOs | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|---|---|---|---|---|---|
| 1 | Describe fundamental concepts, manufacturing methods, basic classifications, and practical applications of microfluidics. | | x | | |
| 2 | Explain the features and dynamics of microscopic fluid flows. | | x | x | |
| 3 | Identify the microfluidic systems used in real-world products. | | | x | |
| 4 | Apply the concepts, principles, and methods related to microfluidics to the analysis and design of products for satisfying the actual needs. | | | x | x |

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

**Teaching and Learning Activities (TLAs)**

| | TLAs | Brief Description | CILO No. | Hours/week (if applicable) |
|---|---|---|---|---|
| 1 | Lecture | Lectures will be given on the topics of the keyword syllabus. | 1, 2, 3, 4 | 3 hrs/week |
| 2 | Mini-project | Students will be asked to carry out a mini-project on the design and analysis of a new microfluidic product for tackling a currently-unsolved issue. | 1, 2, 3, 4 | |

**Assessment Tasks / Activities (ATs)**

| | ATs | CILO No. | Weighting (%) | Remarks (e.g. Parameter for GenAI use) |
|---|---|---|---|---|
| 1 | Test/Assignments | 1, 2, 3, 4 | 20 | In-class quizzes |
| 2 | Mini-project | 1, 2, 3, 4 | 20 | Presentation + report submission on a given topic |

**Continuous Assessment (%)**

40

**Examination (%)**

60

**Examination Duration (Hours)**

2

**Additional Information for ATs**

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

**Assessment Rubrics (AR)**

**Assessment Task**

Test/Assignments

**Criterion**

Ability to understand basic concepts related to microfluidics.

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

Mini-project

**Criterion**

Ability to explain in detail and apply the learned knowledge to the analysis and design of products using microfluidic components to meet the practical needs.

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**
Significant

**Fair (C+, C, C-)**
Moderate

**Marginal (D)**
Basic

**Failure (F)**
Not even reaching marginal levels

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**Assessment Task**
Examination

**Criterion**
Ability to understand the key concepts, principles, methods, and applications of microfluidic systems used in both scientific research and real-world products.

**Excellent (A+, A, A-)**
High

**Good (B+, B, B-)**
Significant

**Fair (C+, C, C-)**
Moderate

**Marginal (D)**
Basic

**Failure (F)**
Not even reaching marginal levels

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**Additional Information for AR**
Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

# Part III Other Information

**Keyword Syllabus**

- Microfluidic devices
- Microscopic fluid flows
- Droplet microfluidics
- Inertial microfluidics
- Digital microfluidics
- Paper-based microfluidics
- Lab-on-a-chip microsystems and applications in chemistry, biology, and medicine
- Microfluidic synthesis of nanomaterials, microparticles/capsules, microfibers, and membranes

## Reading List

### Compulsory Readings

| | Title |
|---|---|
| 1 | Nil |

### Additional Readings

| | Title |
|---|---|
| 1 | Edited by Yujun Song, Daojian Cheng, and Liang Zhao, “Microfluidics: Fundamentals, Devices, and Applications”, John Wiley & Sons, 2018. |
| 2 | Edited by S. Kakaç, B. Kosoy, D. Li, and A. Pramuanjaroenkij, “Microfluidics Based Microsystems: Fundamentals and Applications”, Springer, 2010 |
| 3 | Edited by Dongqing Li, “Encyclopedia of Microfluidics and Nanofluidics”, Springer, 2008. |
| 4 | Nam-Trung Nguyen, Steven T. Wereley, and Seyed Ali Mousavi Shaegh, “Fundamentals and Applications of Microfluidics”, Artech House, 3rd Edition, 2019. |