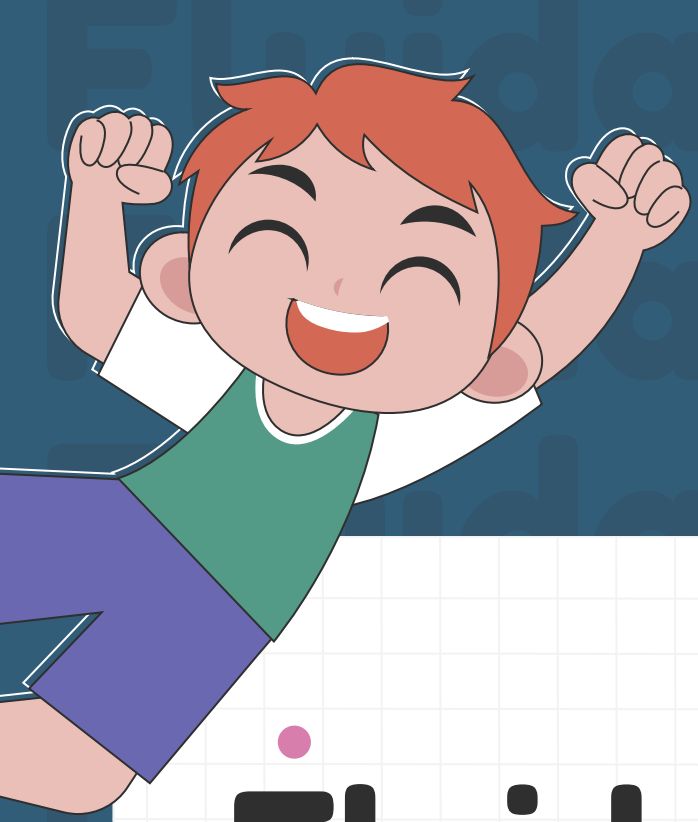


Fluida Master

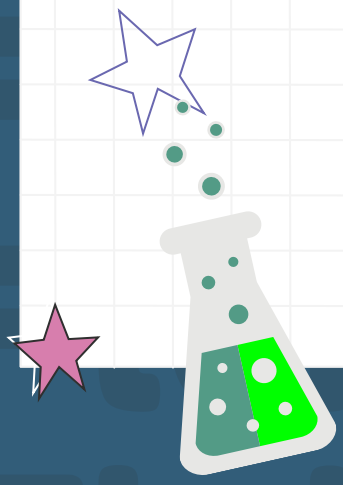
Smart Application of Fluid Mechanics

project by :

Nur Najwa Ainaa Radznee

Mauhibah Miftahuddin

Ainul Haezah Noruzman



Fluida Master

Effective Learning Using
Fluida Master Apps

Special project by :
Nur Najwa Ainaa Radznee
Mauhibah Miftahuddin
Ainul Haezah Noruzman
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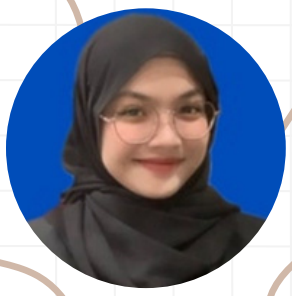
PREFACE

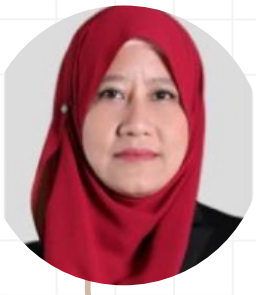
Assalamualikum w.b.t and greeting to all

It gives us a great pleasure to release the first edition of this book as a main reference for student who are enroll in Diploma of Civil Engineering program especially in subject of Fluid Mechanics DCC30122.

The book is compulsory to use when using the Fluida Master application especially for third semester students. The books contains method to install software that will be used to develop Fluida Master applications and how to use the apps.

Happy learning and good luck !





Nur Najwa Ainaa Radznee
Mauhibah Miftahuddin
Ainul Haezah Noruzman
Department of Civil Engineering Polytechnic of Sultan Salahuddin Abdul Aziz Shah

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Course Learning Outcome (CLO)

1.	NAME OF COURSE	FLUIDS MECHANICS
	COURSE CODE	DCC30122
2.	SYNOPSIS	**FLUID MECHANICS** covers the behaviour and characteristics of engineering fluids and their application in hydrostatics and hydrodynamic fluids. This course involves discussion on fluid properties, fluid flow concept and basic equation, moving fluid forces, dimensional analysis, flow in closed conduits and pipe network, and momentum equations..
3.	CREDIT VALUE	2
4.	PREREQUISITE/ CO-REQUISITE (IF ANY)	none
5.	SEMESTER/ YEAR OFFERED	Semester 3 Year 2

7. PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
DIPLOMA IN CIVIL ENGINEERING

The Diploma in Civil Engineering programme shall produce semi-professionals who are:

PEO1 : working in the field of civil engineering

PEO2 : lead or a team member to support their role in industries

PEO3 : engaged in activities to enhance knowledge or starting/embark their own enterprise

PEO4 : fulfill professional and communities responsibilities, conforming to ethical and environmental values

8. PROGRAMME LEARNING OUTCOMES (PLO):

PLO1: apply knowledge of applied mathematics, applied science, engineering fundamentals and an engineering specialisation as specified in DK1 to DK4 respectively to wide practical procedures and practices.

PLO2: identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity (DK1 to DK4).

PLO10: communicate effectively on well-defined engineering activities with the engineering community and with society at large, by being able to comprehend the work of others, document their own work, and give and receive clear instructions.

9. COURSE LEARNING OUTCOMES (CLO):
Upon completion of this course, students should be able to:

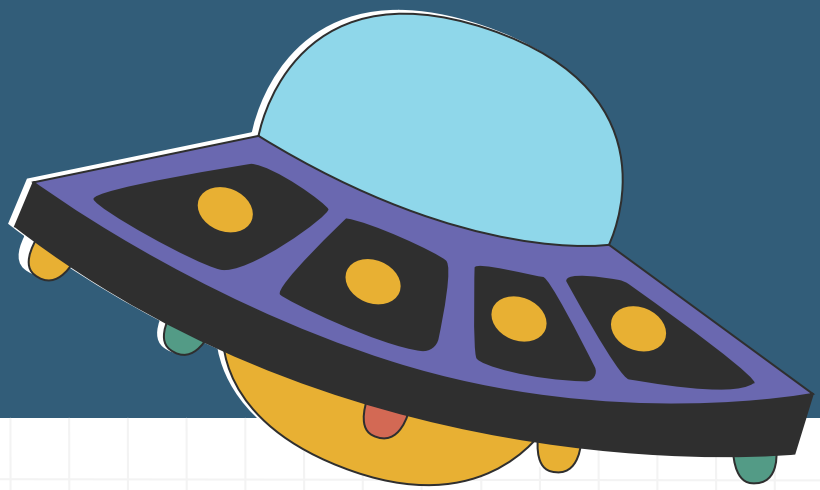
CLO1	Explain the fundamental and principles in fluid mechanics. **(C2, PLO1)**
CLO2	Determine the principles of fluid mechanics engineering in pipe flow appropriately. **(C4, PLO2)**
CLO3	describe verbally the fundamental and principles in fluid mechanics engineering. **(A3, PLO10)**.

10. ASSESSMENT METHOD:

The course assessment consists of:

i. Continuous Assessment (CA) – 100%
ii. Final Examination (FE) – None

Assessment	Quantity	Percentage (%)
Quiz	1	5%
Test	2	20%
Presentation	1	5%
Assignment	2	20%

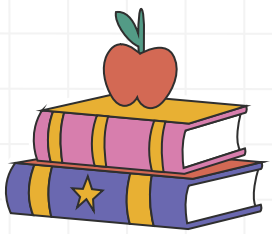


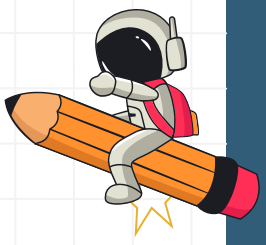
CHAPTER 1

Introduction of Fluid Mechanics

Fluid Mechanics in Engineering

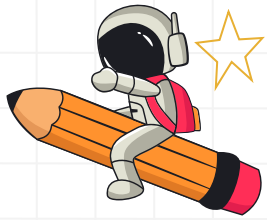
Connecting the math and theory of fluid mechanics to practical applications can be a difficult process. Engineering Fluid Mechanics builds on the success of previous editions to help engineers learn how to apply concepts by keeping them engaged and active throughout the book.





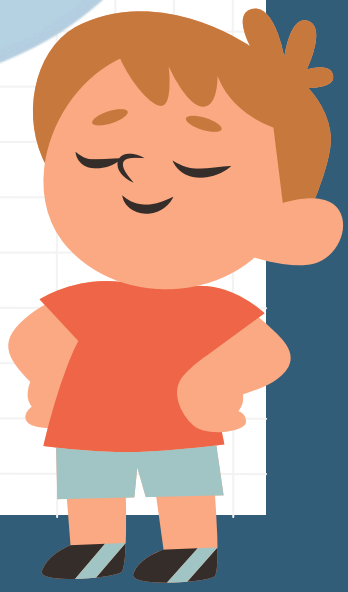
Definition of Fluid Mechanics

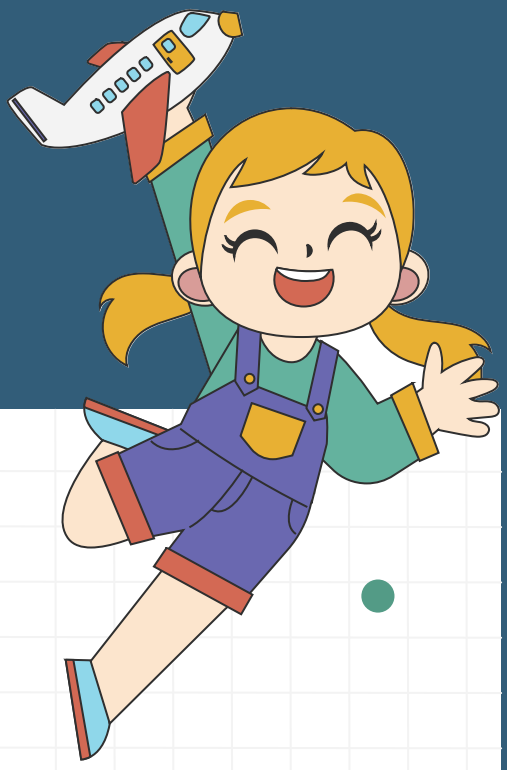
Fluid mechanics is the branch of physics concerned with the mechanics of fluids and the forces on them. It has applications in a wide range of disciplines, including mechanical, aerospace, civil, chemical, and biomedical engineering, as well as geophysics, oceanography, meteorology, astrophysics, and biology.



What Is Fluid?

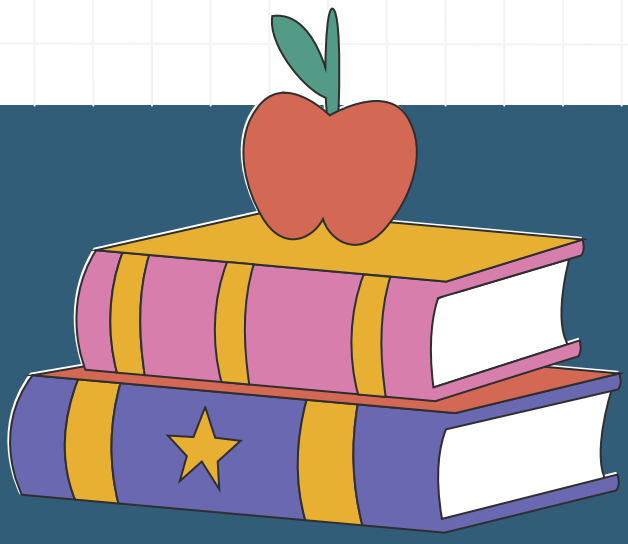
A fluid is a liquid, gas, or other material that may continuously move and deform under an applied shear stress, or external force.





CHAPTER 2

Introduction of Each Topic



TOPIC 1

Density

Density is a physical property that measures the mass of a substance per unit volume. It is commonly expressed as:

$$\text{Density}(\rho) = \frac{\text{Mass}(m)}{\text{Volume}(V)}$$

The standard unit of density is kilograms per cubic meter (kg/m^3) in the SI system.

Specific Weight

Specific weight, also known as weight density, is the weight per unit volume of a material. It is given by the formula:

$$\text{Specific Weight}(\gamma) = \frac{\text{Weight}(W)}{\text{Volume}(V)}$$

Since weight is the force exerted by gravity on a mass, specific weight can also be expressed as:

$$\gamma = \rho g$$

Where:
- ρ is the density of the material
- g is the acceleration due to gravity (approximately \(9.81 \, \text{m/s}^2\) on Earth)

The standard unit of specific weight is newtons per cubic meter (N/m^3) in the SI system. Specific weight is used in fluid mechanics to describe the weight of a fluid relative to its volume.

Specific Volume

Specific volume is the volume occupied by a unit mass of a substance. It is the reciprocal of density and is expressed as:

$$\text{Specific Volume}(v) = \frac{1}{\text{Density}(\rho)} = \frac{V}{m}$$

Where:
- V is the volume
- m is the mass
- ρ is the density of the substance

The standard unit of specific volume in the SI system is cubic meters per kilogram (m^3/kg).

Specific Gravity

$$\text{Specific Gravity}(SG) = \frac{\text{Density of the substance}(\rho_{\text{substance}})}{\text{Density of the reference substance}(\rho_{\text{reference}})}$$

$$SG = \frac{\rho_{\text{substance}}}{1000\,\text{kg/m}^3}$$

Viscosity

The relationship between dynamic viscosity and kinematic viscosity is:

$$\nu = \frac{\mu}{\rho}$$

Where:

- ν = Kinematic viscosity
- μ = Dynamic viscosity
- ρ = Density of the fluid

TOPIC 2

Pressure

$$P = \frac{F}{A}$$

Where:

- P is the pressure,
- F is the force applied,
- A is the area over which the force is applied.

Gauge Pressure

$$P_{\text{gauge}} = P_{\text{absolute}} - P_{\text{atmospheric}}$$

Absolute Pressure

$$P_{\text{absolute}} = P_{\text{gauge}} + P_{\text{atmospheric}}$$

Where:

- P_{absolute} is the absolute pressure,
- P_{gauge} is the gauge pressure (pressure relative to atmospheric pressure),
- $P_{\text{atmospheric}}$ is the atmospheric pressure (approximately 101.3 kPa at sea level).

U tube Manometer

$$\Delta P = \rho \cdot g \cdot h$$

Where:

- ΔP = Pressure difference (Pa or N/m²)
- ρ = Density of the liquid in the manometer (kg/m³)
- g = Acceleration due to gravity ($9.81\,\mathrm{m/s^2}$)
- h = Height difference between the liquid columns (m)

TOPIC 3

Reynolds Number

$$Re = \frac{\rho v L}{\mu}$$

Where:

- ρ is the density of the fluid (kg/m³),
- v is the flow velocity (m/s),
- L is a characteristic length (such as diameter for a pipe) (m),
- μ is the dynamic viscosity of the fluid (Pa·s or N·s/m²).

Alternatively, it can also be expressed in terms of kinematic viscosity ($\nu = \frac{\mu}{\rho}$):

$$Re = \frac{vL}{\nu}$$

Rate Of Flow / Discharge

$$Q = A \cdot v$$

Where:

- Q is the volumetric flow rate (m³/s),
- A is the cross-sectional area through which the fluid flows (m²),
- v is the velocity of the fluid (m/s).

The SI unit for volumetric flow rate is cubic meters per second (m³/s).

TOPIC 4

Continuity Equation

$$A_1 v_1 = A_2 v_2$$

Where:

- A_1 and A_2 are the cross-sectional areas at two points in the flow.
- v_1 and v_2 are the flow velocities at those points.

Bernoulli Equation

$$\frac{P_1}{\rho g} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\rho g} + \frac{V_2^2}{2g} + Z_2$$

Where :
- A1 = area of pipe at section 1
- V1 = velocity of pipe at section 1
- ρ1 = density of pipe at section 1
- A2, V2, ρ2 = corresponding values at section 2

TOPIC 5

Sudden Enlargement

$$h_L = \frac{(v_1 - v_2)^2}{2g}$$

Where :
- v1 = velocity at section 1
- v2 = velocity at section 2

Sudden Contraction

$$h_L = [\frac{1}{C_c} - 1]^2 \times \frac{(v_2)^2}{2g}$$

Where :
- Cc = coefficient contraction @ a1/a2
- v2 = velocity at section 2

Exit Loss

$$h_L = \frac{(v_2)^2}{2g}$$

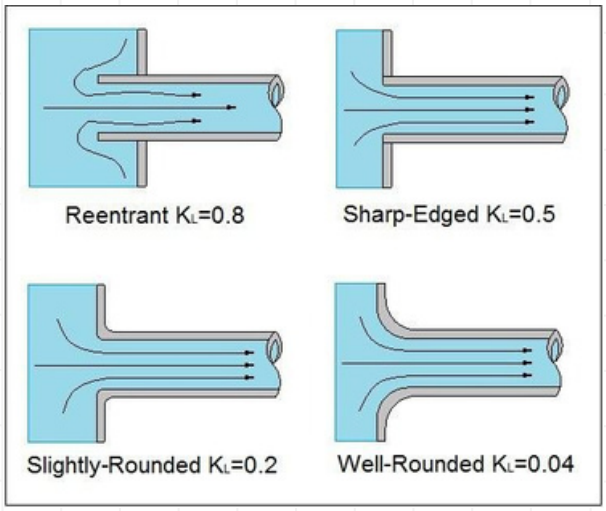
Where :
- v2 = velocity at section 2

Pipe Bends

$$h_L = K \cdot \frac{v^2}{2g}$$

Where :
- **hI** is the head loss (m).
- **K** is the entrance loss coefficient (dimensionless).
- **v** is the fluid velocity (m/s).
- **g** is the acceleration due to gravity

Entrance Loss



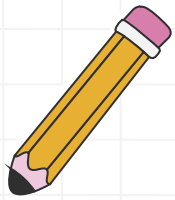
$$h_L = \frac{0.5v^2}{2g}$$

Where :
- **v** is the fluid velocity (m/s).
- **g** is the acceleration due to gravity

CHAPTER 3

Introduction of Fluida Master Apps

FLUIDA MASTER



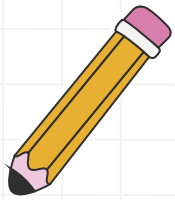
Introduction Fluida Master

Fluida Master application is an application based on Fluid Mechanics subjects registered under DCC30122. The subject is offered in semester three as a civil engineering major subjects.

This Fluida Master app is a device that helps student perform the calculations found in the subject. The calculation topics involved are topic 1 until topic 5.

The function of Fluida Master was created to help student to do calculations more quickly and accurate. Therefore, students can save time and make easier for students to understand the sub-topics taught in class.

In addition, this app also have formula and user manual on the main display to help students understand the calculations and figure out how to use the app. Utilizing this apps, students can opened the formula inside for quick and fast references.



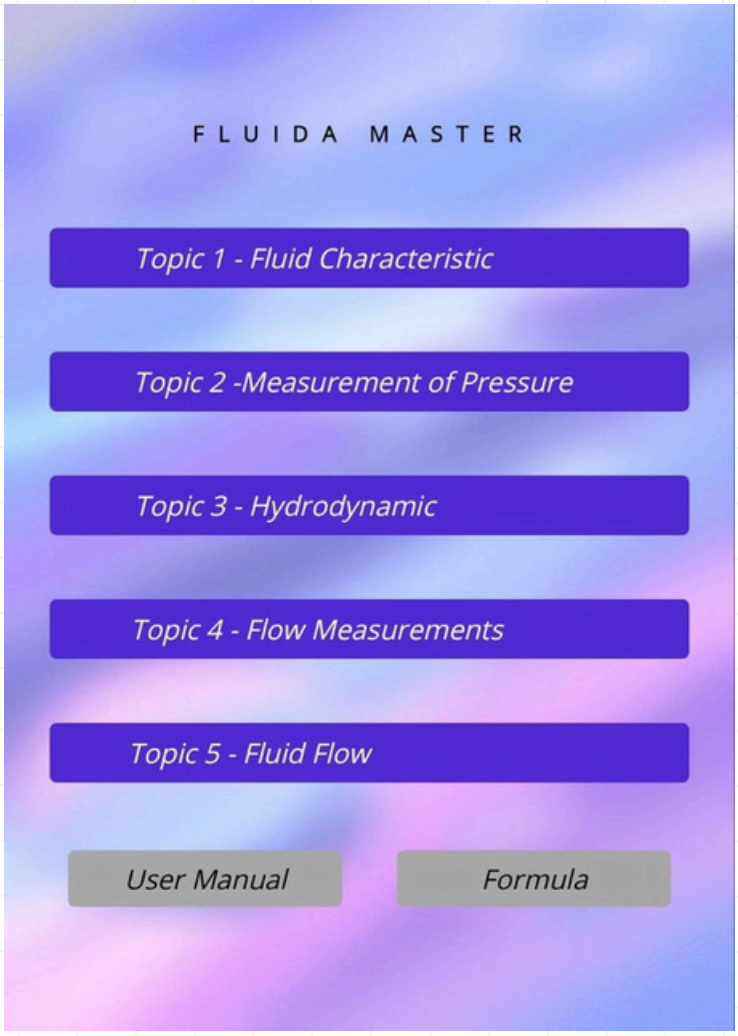
Introduction Fluida Master

Title : Effective Learning Using Fluida Master Apps (Fluida Master)
Aim : The goal of creating of Fluida Master application is to help student learn more effectively

Objective of Fluida Master apps :
- To produce smart application Fluida Master for student effective learning.
- To evaluate student learning performance using smart application (Fluida Master)
- To determine the satisfaction among the students using smart application (Fluida Master)

Advantages of Fluida Master :
- Help students to understand the basic of Fluid Mechanics and how the calculation are done
- Help students to speed up the calculations process.
- The application is simple, easy to use and quick to load.

What is inside the Apps ?



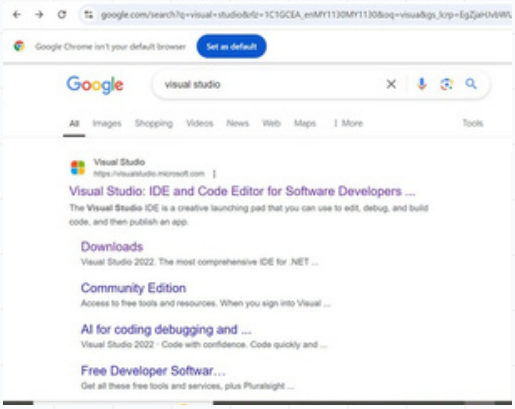
Basic Content : Calculator for Topic 1 until Topic 5

Additional Content 1 : User Manual

Additional Content 2 : Formula

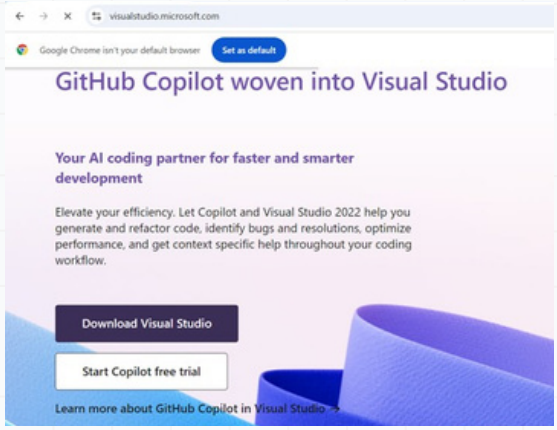
Method to Install Software to Develop Fluida Master

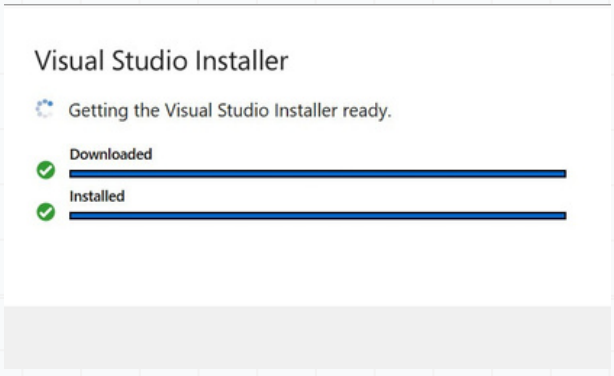
Using .NET MAUI



1. Open google and search for Visual Studio

2. Click download

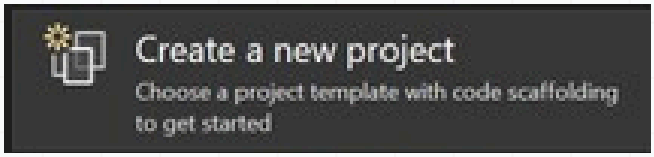


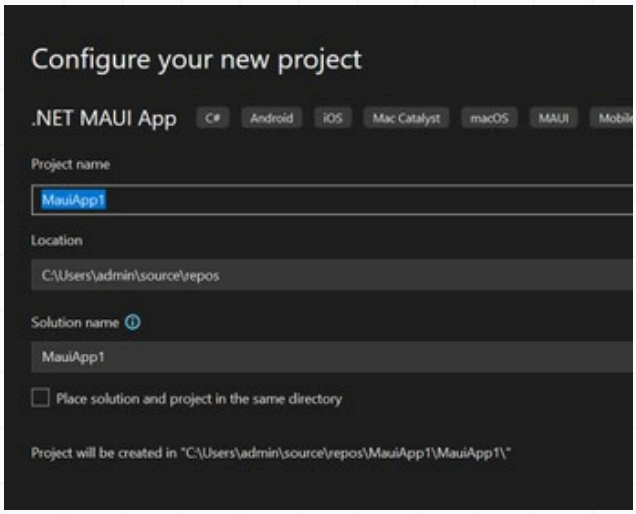


3. After download, click Visual Studio

Method to Install Software to Develop Fluida Master

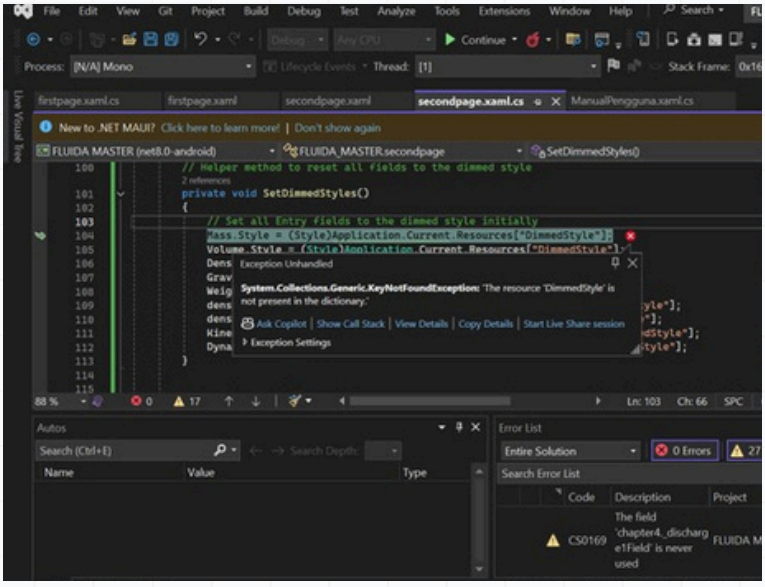
4. Create a new project then clicked Net MAUI option



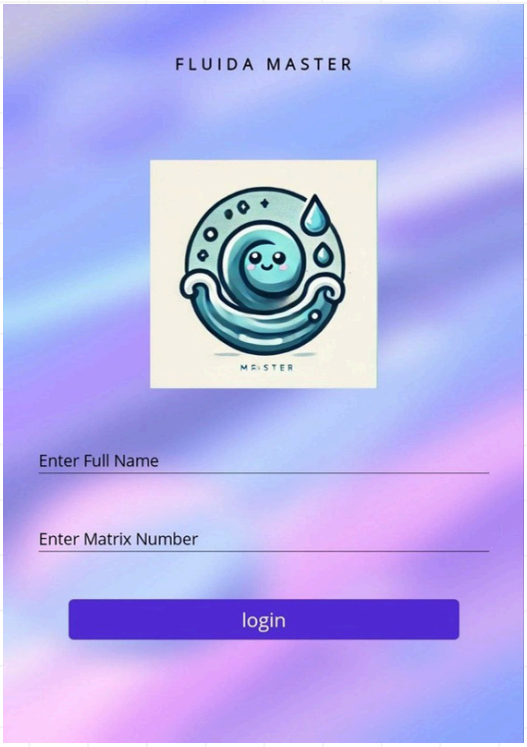


5. Rename your project

6. Start the the coding

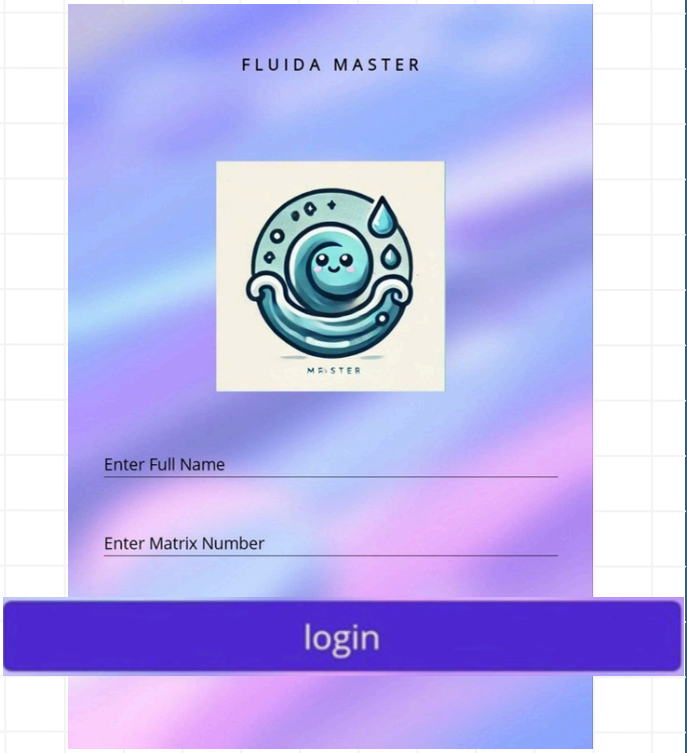


How to Use Fluida Master Application

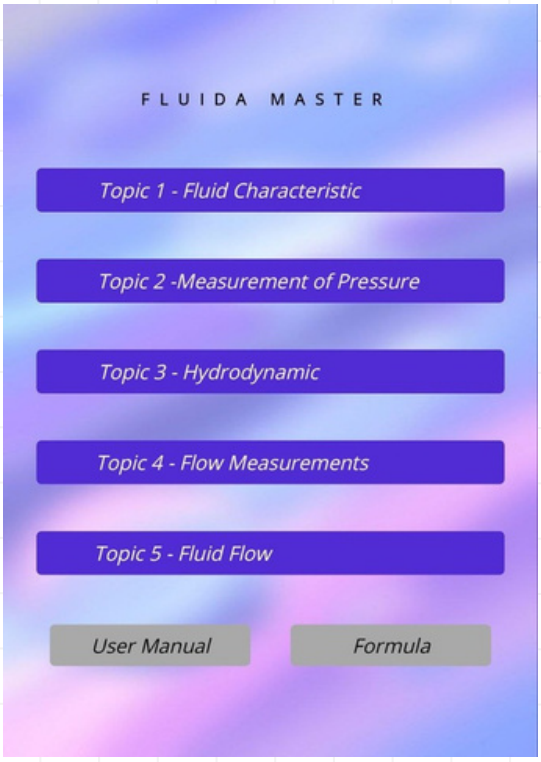


1. Firstly, insert all of the details.

2. Click log in.



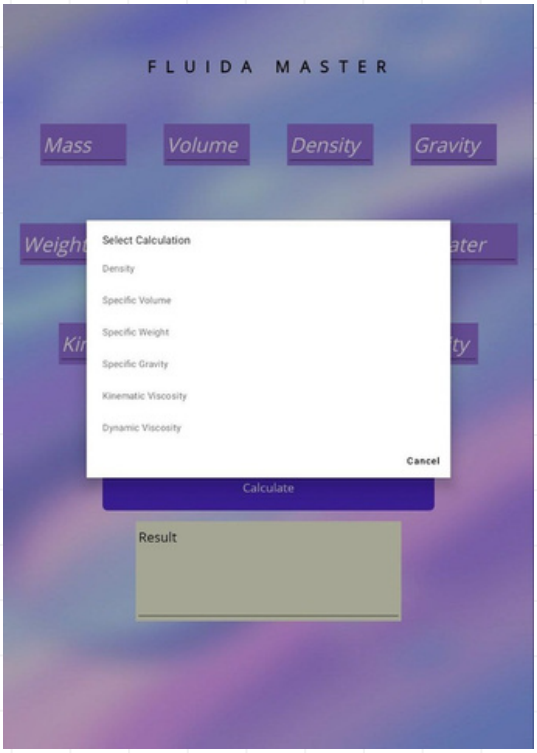
How to Use Fluida Master Application



3. Choose and click the topic you want to calculate.
Topic 1 - topic 5.

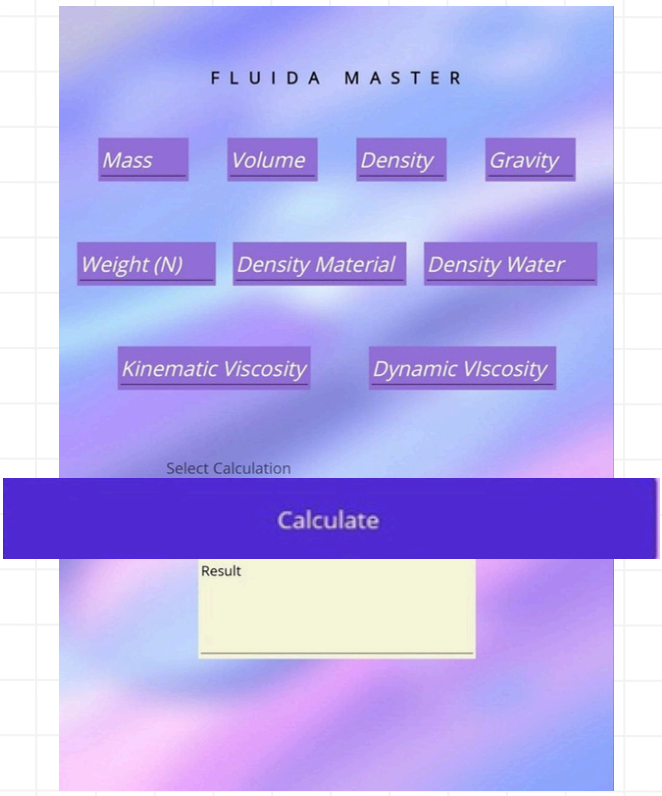
4. Insert all the data that have been given in the question in the box.

How to Use Fluida Master Application

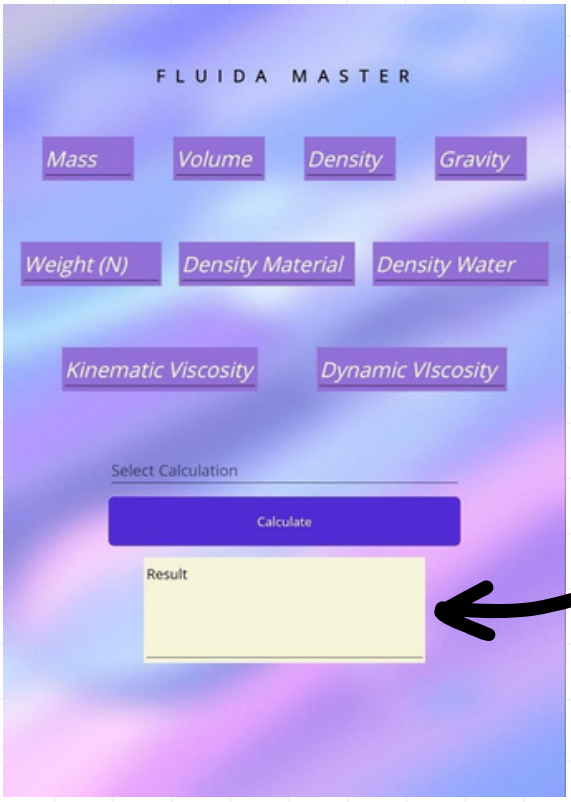


5. Select the calculation that you want to calculate in the option.

6. Click calculate.

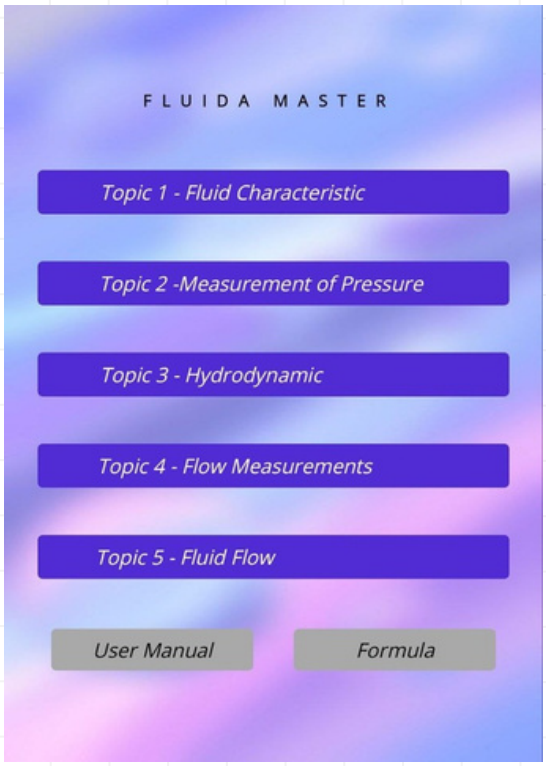


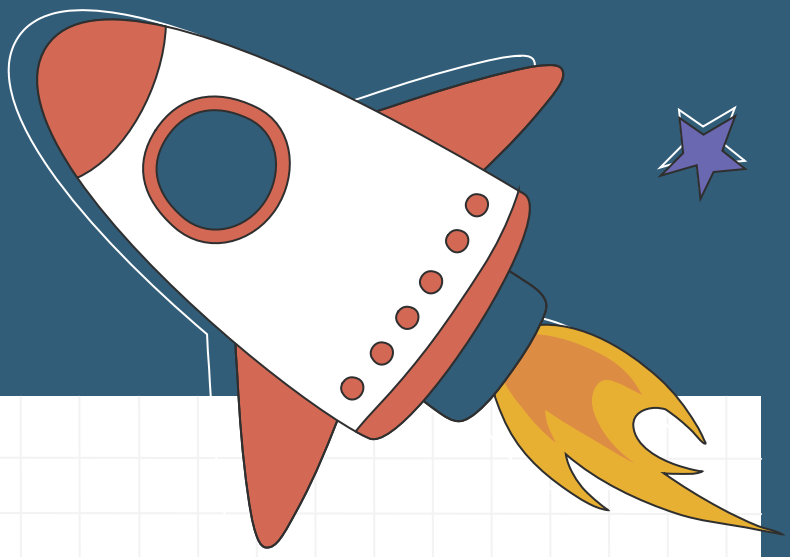
How to Use Fluida Master Application



7. The answer will appear at the box below as shown in the figure.

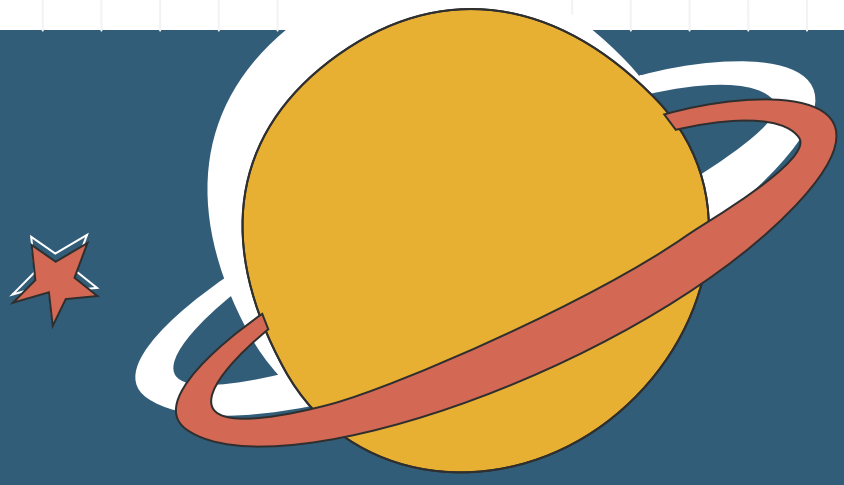
8. Repeat step 3-4 for other calculation at different topics.





Chapter 4

Question & Answer



Questions

Topic 1

1) Mass = 500 kg
Volume = 2 m^3
Find the Density

2) Density = 1000 kg/m^3
Gravity = 9.81
Find the Specific Weight

3) Density = 800 kg/m^3
Density of water = 1000kg/m^3
Gravity = 9.81
Find the Specific Gravity

4) Density = 1.2 kg/m^3
Find the Specific Volume

Questions

Topic 2

1) Force = 200N
Area = 4 m^2
Find the Pressure

2)Height = 10m
Density of Water = 1000 kg/m^3
Gravity = 9.81
Find the Pressure Head

3) Force = 150N
Area = 3 m^2
Find the Pressure

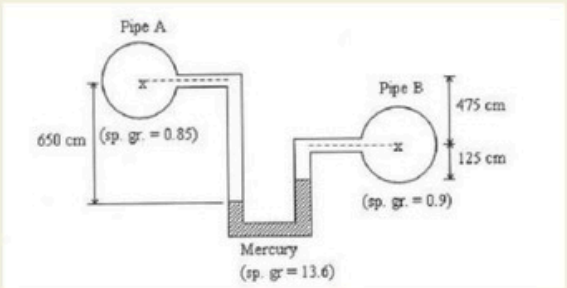
4) Gauge Pressure = 200 000 Pa
Atmospheric Pressure = 101 325 Pa
Find the Absolute Pressure

Questions

Topic 2

5) Differential Manometer

A differential manometer, when connected to two pipes A and B, gives the readings as shown in Figure below. Determine the pressure (kN/m²) in the tube A, if the pressure in the pipe B be 55 kN/m².



TIPS : Change specific gravity to density
: Change cm to m.
: Insert the data according to the box in the application.
: Check the unit.

Questions

Topic 3

1) Density = 1000 kg/m^3
   Velocity = 3 m/s
   Diameter = 0.5m
   Dynamic Viscosity = 0.001 Pa
   Find the Reynolds Number

2) Density = 850 kg/m^3
   Velocity = 1.5 m/s
   Diameter = 0.1 m
   Dynamic Viscosity = 0.002 Pa
   Find the Reynolds Number

3) Density = 950 kg/m^3
   Dynamic Viscosity = 0.002 Pa
   Find the Kinematic Viscosity

4) Density = 1200 kg/m^3
   Dynamic Viscosity = 0.0015 Pa
   Find the Kinematic Viscosity

Questions

Topic 4

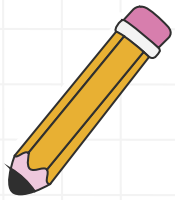
1) Velocity = 3 m/s
   Area = 0.02 m^2
   Find the Discharge

2) Pressure = 200 000 Pa
   Density = 1000 kg/m^3
   Elevation = 5 m
   Gravity = 9.81
   Velocity = 4 m/s
   Find the Height

3) Velocity = 5 m/s
   Area = 0.04 m^2
   Find the Discharge

4) Pressure = 150 000 Pa
   Density = 1000 kg/m^3
   Elevation = 3 m
   Gravity = 9.81
   Velocity = 6 m/s
   Find the Height

Questions



Topic 5

1) Velocity at Section 1 = 4 m/s
   Velocity at Section 2 = 2 m/s
   Elevation = 3 m
   Find the Sudden Enlargement

2) Coefficient Contraction = 0.62
   Velocity at Section 2 = 3 m/s
   Gravity = 9.81
   Find the Sudden Contraction

3) Entrance Head = 3 m/s
   Gravity = 9.81
   Find the Exit Loss

4) Velocity at Pipe = 5 m/s
   Gravity = 9.81
   Find the Entrance Loss

5) Loss Coefficient = 0.4
   Velocity = 2.5 m/s
   Gravity = 9.81
   Find the Pipe Bends

Answers

Topic 1

1) $\rho = m/v$
$= 500/2$
$= 250\ kg/m^3$

2) $Ws = \rho \times g$
$= 1000 \times 9.81$
$= 9810$

3) 0.8
4) $0.83\ m^3$

Topic 2

1) $P = 200/4$
$= 50\ Pa$
2) Pressure head $= 1000 \times 9.81 \times 10$
$= 98100$
3) $50\ Nm^3$
4) 301325 N
5) $78544\ N/m^2$

Answers

Topic 3

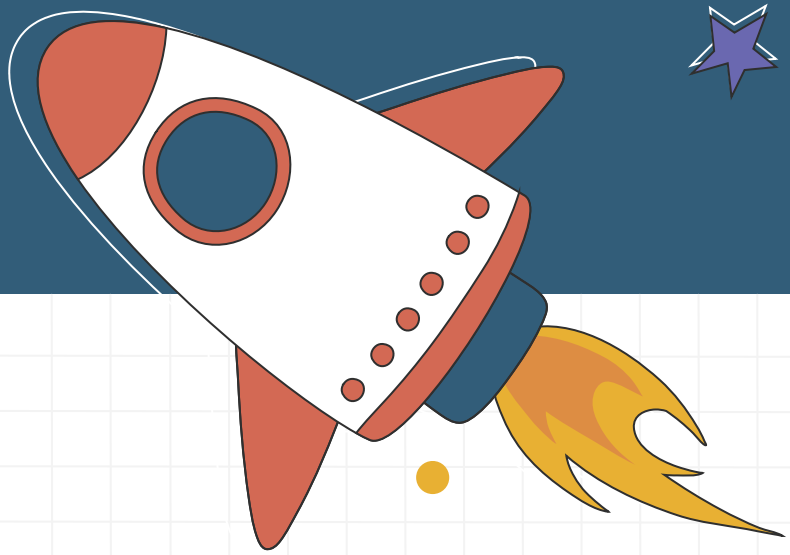
1) Re = 1000 x 3 x 0.5 /0.001
= 1500000 Pa
2) Re = 850 x 1.5 x 0.1 / 0.002
= 63750
3) 0.000002105
4) 0.00000125

Topic 4

1) Q = 3 x 0.02
= 0.06 m^3/s
2) 26.203 m
3) 0.2 m^3/s
4) 20.125 m

Topic 5

1) Sudden Enlargement = $(4-2)^2$ / 2 x 9.81
= 0.204 m
2) 0.172 m
3) 0.458 m
4) 0.64 m
5) 0.13 m



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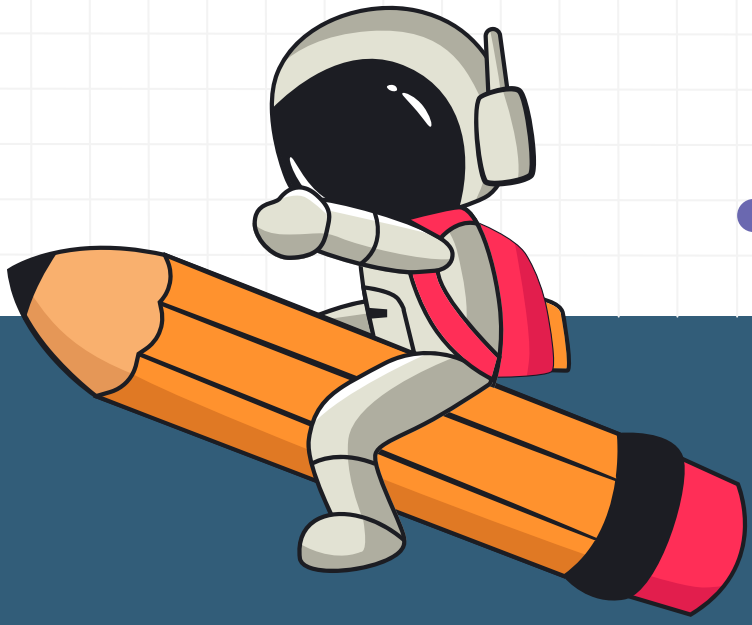

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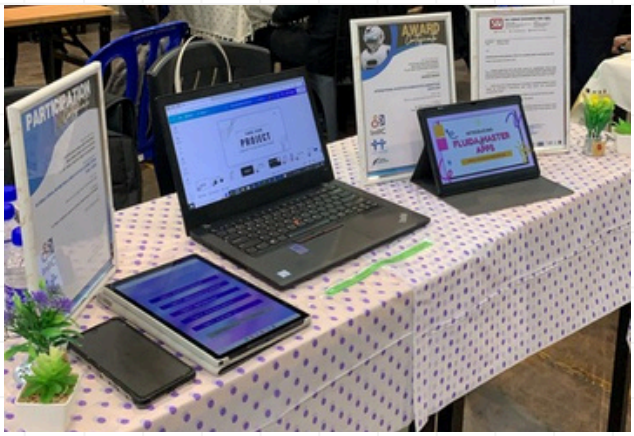

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Chapter 20
Effective Learning Using Fluida Master Apps

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ABSTRACT

The project, "Effective Learning Using Fluida Master Apps," addresses the problem of high fluid mechanics failure rates among Civil Engineering students at Polytechnic Sultan Salahuddin Abdul Aziz Shah. To address this issue, the "Fluida Master" instructional mobile app was created to make fluid mechanics more accessible and effective. To assist students better understand challenging ideas, the app includes an easy-to-use user interface (UI). The app's features seek to bridge the gap between theoretical knowledge and practical application, therefore boosting students' understanding and overall performance in fluid mechanics. Fluida Master includes various new features, including real-time data analysis, customised learning routes adapted to individual student progress, and convenient, on-the-go access to instructional content. This allows students to work at their own pace and gain a better knowledge of complex topics. The app's problem-solving modules enable users to enter theoretical knowledge through practical, interactive learning. Furthermore, the software encourages active learning and ecologically responsible education by reducing the need for actual textbooks. Initial user feedback has been excellent, with many pupils claiming enhanced comprehension and academic achievement after using the program. Overall, the Fluida Master app has significant promise for improving the learning experience in fluid mechanics and might be a useful tool for engineering students.

Key Words: accessible, effective, Fluida Master, mobile learning, apps

1. INTRODUCTION

Educational software and educational games have greatly benefited from instructional software and games; these tools have made it easier for students to understand concepts that would otherwise be difficult in real-world industrial situations. Philpot (2004) emphasizes the significance and relevance of instructional software in engineering education in his work on mdsolids, a software for a "mechanics of materials" course. An educational software application that allows pupils to learn autonomously rather than being taught in a typical classroom. Students can examine and research a range of difficulties in a short period of time, gaining confidence and accomplishing course learning outcomes. (Philpot & Hall, 2004) The ideal companion for civil engineering students venturing into the field of fluid mechanics. This revolutionary mobile application provides a seamless blend of comprehensive and strong problem-solving skills, all available at your fingertips. Fluida Master allows students to access calculations that span all aspects of fluid mechanics, ensuring a full comprehension of important concepts. Furthermore, the built-in problem solver provides answers to a wide range of fluid

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mechanics problems, helping students to face challenges with confidence and speed. Fluida Master goes beyond standard learning methods, providing an interactive and customized experience. Fluida Master learn is the go-to resource for civil engineering students who want to learn the concepts of fluid mechanics with ease and proficiency, whether they are studying on the move or delving deeply into difficult equations.

2. LITERATURE REVIEW

Mobile applications, specifically, are designed to work on smartphones, tablets, and other mobile devices. They are typically downloaded and installed from app stores or marketplaces. These apps provide users access to a wide range of services, such as social media, navigation, entertainment, education, and more Smith, J. (2021). Mobile apps have become crucial to today's digital economy, beginning with the launch of the iPhone in 2007 and the App Store in 2008. By 2022, Android users could access 355 million apps on Google Play, while the Apple App Store had 16 million apps. The rise of the internet and mobile devices in the 1990s and 2000s gave way to web-based applications such as email and search engines, before smartphones and tablets enabled the rise of mobile apps. Since 2010, cloud computing has made web-based apps available from anywhere with an internet connection, while app shops such as Google Play and the Apple App Store have eased app distribution and monetization. Advances in development tools have made it easier to create apps across platforms, allowing them to adapt with users (Koetsier, J., 2021).

Apps have changed the way we interact with technology, bringing several benefits to users, organizations, and developers. One of the primary benefits is convenience, as apps make it simple to access tools, services, and information on smartphones, tablets,

and other devices. They also improve efficiency by automating jobs and streamlining procedures, which increases productivity for both individuals and businesses Johnson, M. (2022). Furthermore, applications improve accessibility by making services and information more accessible to persons with impairments, as well as providing personalization to promote more interesting user interactions. Hence, the apps boost connectivity, allowing users to stay in touch via social media, messaging, and video chat. They offer entertainment options such as games, streaming services, and multimedia content, allowing you to rest and unwind Davis, K., & Lee, H. (2020). Apps also produce significant money through sales, advertisements, subscriptions, and in-app purchases, all while broadening market reach by making products and services more accessible globally. Overall, apps have become an indispensable component of contemporary life, providing countless advantages and prospects for innovation and growth Rodriguez, P. (2023).

Mobile education apps have revolutionized learning by providing accessible, flexible, and cost-effective solutions for users worldwide. They enable personalized learning experiences with interactive elements like quizzes and games, which boost engagement and retention. With features such as instant feedback and adaptive content, these apps cater to individual progress while making education more accessible to people from different locations and backgrounds. Through gamification and skill-focused modules, they also foster motivation and specific skill development, offering a more engaging and efficient way to learn on the go. Johnson, R. (2023).

3. METHODOLOGY

The primary goal of this suggested application is to improve students' ability to execute accurate fluid mechanics calculations. The app's user-friendly interfaces and well-crafted activities will provide targeted practice opportunities for students to reinforce their learning and gain confidence in their problem-solving abilities. The project development was show in Figure 1.

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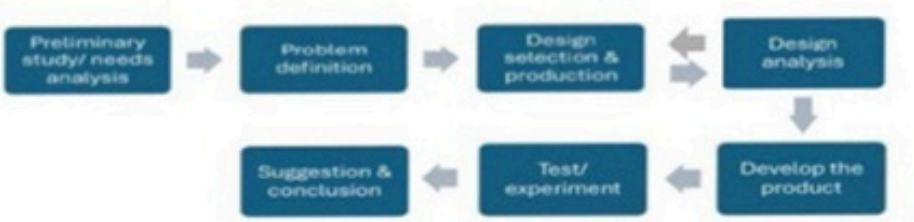

Figure 1: Flow Chart Development Project

3.1 Software Application

.NET Multi-platform App UI (.NET MAUI) is a cross-platform framework for developing native mobile and desktop applications using C# and XAML. .NET MAUI allows you to create apps that operate on Android, iOS, macOS, and Windows from a single shared codebase.

Figure 2: Operating Software

.NET MAUI is an open-source development of Xamarin.Forms are expanded from mobile to desktop scenarios, and UI controls have been rewritten from the bottom up for performance and extensibility. If you've already used Xamarin.Forms to create cross-platform user interfaces, you'll notice a lot of parallels to. NET MAUI. However, there are some variances. .NET MAUI allows you to construct multi-platform apps in a single project, but you can add platform-specific source code and resources as needed. One of the primary goals of .NET MAUI is to allow you to integrate as much app functionality and UI layout as feasible in a single codebase.

4. RESULT AND DISCUSSION

.NET MAUI greatly improved the performance and cross-platform support of Fluida Master. With .NET MAUI, we can now use a single codebase to run the app on Android, iOS, macOS, and Windows, saving time and effort. This upgrade makes the app faster, smoother, and more efficient in delivering fluid mechanics calculations, providing users with a seamless experience across different devices. Fluida Master remains focused on offering quick and accurate results for students and professionals.

However, the transition to .NET MAUI came with some challenges. We had to rework parts of the code and deal with compatibility issues across different platforms. Integrating specific features for various devices and making sure the app worked consistently everywhere took extra effort. Despite these challenges, Fluida Master has been developed by .NET MAUI and it has made Fluida Master more stable and ready for future updates.

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5. CONCLUSION AND RECOMMENDATION

Fluida Master's capabilities have significantly improved with the adoption of .NET MAUI, making the app more efficient and user-friendly. Designed to provide quick solutions to fluid mechanics problems, the app delivers instant results based on user input. Its primary goal of providing accurate and timely data makes it a valuable tool for both engineering students and professionals. The successful development of Fluida Master has been achieved using .NET MAUI.

To enhance the app further, reintroducing a step-by-step explanation feature could benefit users interested in deepening their understanding of fluid mechanics. Offering this as an optional feature would balance between providing quick solutions and offering more detailed instruction. Additionally, regular updates to the user interface and performance through .NET MAUI will help ensure long-term success and user satisfaction.

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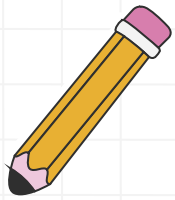

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Together, we have reached remarkable milestones that once seemed like distant dreams. Each achievement is a testament to the power of collaboration, shared vision, and the unyielding determination of a group united by common goals. It is your collective dedication that continues to propel us forward, enabling us to aspire to even greater things. Thank you for being an indispensable part of our story. Your impact is immeasurable, and we are honored to have you as part of our journey. As we look ahead, we are excited and motivated by the thought of all we can achieve together. You inspire us to reach new heights, and with your continued support, there is no limit to what we can accomplish.

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