Course Specification
(Bachelor)

Course Title	**Fluid Mechanics**
Course Code:	**PHY 1404**
Program:	**Bachelor of Science in Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	4
Last Revision Date:	***26/09/2024***

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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: (Level 7/ Year4)

4. Course General Description:

This course covers the basic concepts and principles of modern fluid mechanics. It examines the fundamental aspects of fluid motion including important fluid properties, regimes of flow, pressure variations in fluids at rest and in motion, methods of flow description and analysis. The course consists of examples and text involving everyday situations to reinforce the concept that fluid mechanics is an important part of our world as well as enabling students to master problem solving skills.

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

Mathematical Physics (2), PHY 1334

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

7. Course Main Objective(s):

- **Understand the fundamental a fluid mechanics fundamental, including concepts of mass and momentum conservation.**
- **Apply the Bernoulli equation to solve problems in fluid mechanics.**
- **Apply control volume analysis to problems in fluid mechanics.**
- **Use potential flow theory to solve problems in fluid mechanics.**
- **Gain a knowledge of laminar and turbulent boundary layer fundamentals.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
5.	**Others (specify)**	**0**
Total		55

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

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Outline the basic concepts and principles of fluid mechanics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Define and interpret fluid statics, kinematics and dynamics.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Apply the concepts of the continuity, energy and momentum equations and flow measurements in fluid flows.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. Homework.
1.4	**Demonstrate basic knowledge of fluid mechanics of water waves and particle displacement.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			
2.1	**Explain and summarize the basic knowledge gained from studying waves and optical physics.**	**S1, S2**	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Develop the students ability to solve and**	**S2, S3**	▪ Problem classes and group tutorial.	▪ Exams. ▪ Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	analyze problems in physics related the topics covered by the course.		Homework assignments as well as problems solutions.	Homework.
2.3	**Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.**	**S4, S5**	• Lectures. • Class discussions. • Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ Exams. ▪ Participation and activities of students in the course community and blackboard. ▪ Homework.
3.0	**Values, autonomy, and responsibility**			
3.1	**Show the collaboration and inter-professionalism in class discussions or team works, as well as solve problems independently.**	**V1, V2, V3**	• Small team tasks • Open discussion at classroom. Office hours.	▪ Participation. ▪ Homework. Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Fluid Mechanics Basics:** Flow, Pressure, Properties of fluids, Viscosity.	**10**
2.	**Statics:** Hydostatic pressure, Manometer –pressure measurement. Hydrostatic forces on submerged surfaces.	**10**
3.	**Kinematics:** Particle paths and streamlines, material derivatives, continuity equation, incompressibility and stream-function, analysis of motion relative to a point (in -2D), irrotational flow, velocity potential, complex potential.	**12**
4.	**Momentum and energy in inviscid flow:** Body forces and stresses Euler's momentum equation, hydrostatics, Brenoulli's theorem and its applications, Kelvin's circulation theorem.	**10**
5.	**Potential flow:** Uniform stream, line-source, dipole, line-vortex, modeling of flow round cylinders.	**10**
6.	**Linear water waves:** Particle paths, phase and group velocity.	**8**
	Total	**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Class Activities (class quizzes, homework, solving problems, etc.....)	weekly	10 %
2.	Midterm Exam 1	6thweek	25 %
4.	Midterm Exam 2	12thweek	25 %
5.	Final Exam	16thweek	40 %

*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	- Young D.F., Munson B.R., Okiishi T.H. and Huebsch W.W., ***Introduction to Fluid Mechanics,*** SI Version, 5th Edition, Wiley (2011).
Supportive References	- ***Robert W.F., Alan T.M, and Pritchard P.J., Introduction*** to fluid mechanics, 6th Edition, Wiley (2004). - Prieve D.C., ***A Course in Fluid Mechanics with Vector Field Theory,*** Web Draf (2000). - Chorin A. and Marsden J.E., ***A Mathematical Introduction to Fluid Mechanics,*** 4th Edition, Springer-Verlag Publishing Company (2000).
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	

2. Required Facilities and equipment

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

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	- Students - Second examiner	- Indirect (The students complete the evaluation forms at the end of term. Final exam is evaluated by the second examiner)
Effectiveness of Students assessment	- Instructors -	- Direct (exams, HW, project, ...)
Quality of learning resources	- Faculty - Students	- Indirect (surveys)
The extent to which CLOs have been achieved	- Instructors - Program Leaders	- Direct (excel sheet)
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Quality Unit-Physics Department
REFERENCE NO.	Department council No. 06
DATE	26/09/2024