



Course Specification

(Bachelor)

Course Title: **Fluid mechanics and Hydraulics**

Course Code: **COE3601**

Program: **Bachelor of Construction Engineering**

Department: **Civil and Environmental Engineering Department**

College: **College of Engineering and Computing in Al-Qunfudhah**

Institution: **Umm Al-Qura University**

Version: **1st**

Last Revision Date: **March 2025**



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A. General information about the course:

1. Course Identification

1. Credit hours: (4) (3+1)

2. Course type

A.	<input type="checkbox"/> University	<input type="checkbox"/> College	Department	<input type="checkbox"/> Track	Others
B.	<input checked="" type="checkbox"/> Required		<input type="checkbox"/> Elective		

3. Level/year at which this course is offered: (Level 6 / Year 3)

4. Course General Description:

This course provides a comprehensive introduction to fluid properties and flow behavior, focusing on both pipe flow and open channel flow analysis. Key topics include pressure measurement, hydrostatic forces on surfaces, buoyancy, and fundamental fluid flow equations such as continuity, energy, and momentum, along with their engineering applications. Students will explore dimensional analysis, flow through conduits, and the distinctions between pipe and open channel flow. Additional topics include geometric properties of channel sections, specific energy concepts, uniform and gradually varied flow, hydraulic jumps, and hydraulic structures. The course also introduces the fundamentals of pumps and turbines. Laboratory sessions and hands-on experiments will reinforce theoretical concepts through practical applications and measurement techniques.

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

Dynamics (COE2103)

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

7. Course Main Objective(s):

This course aims to equip students with a fundamental understanding of fluid properties and their applications in engineering. Students will learn to analyze and calculate flow characteristics in fluid systems, including pipe flow and open channel flow under various hydraulic conditions. The course will also cover key hydraulic factors influencing the design of pipelines and hydraulic structures. Additionally, students will develop hands-on experience by conducting laboratory experiments, analyzing measurements, and evaluating fluid behavior through practical applications.



2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	90	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> • Traditional classroom • E-learning 		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	45
3.	Field	
4.	Tutorial	
5.	Others (specify)	
Total		90

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			



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.1	Recognize and describe the various fluid and fluid flow properties	K2	Lecture	Assignment, Quiz, Midterm and final exam
1.2	Recognize the principles and properties of the flow through pipe, pipe network analysis, open channel and hydraulic structures	K1	Lecture	Assignment, Quiz, Midterm and final exam
2.0	Skills			
2.1	Measure the pressure in the pipes and hydrostatic pressure on curved and plane surfaces and stability of floating bodies.	S1	Lecture	Assignment, Quiz, Midterm and final exam
2.2	Measure fluid properties using energy and momentum equations.	S1	Lecture	Assignment, Quiz, Midterm and final exam
2.3	Apply the knowledge of hydraulic engineering, hydraulic models and design the elements of hydraulic structures.	S1	Lecture	Assignment, Quiz, Midterm and final exam
2.4	Analyze single pipes and simple combinations of pipes under steady flow.	S1	Lecture	Assignment, Quiz, Midterm and final exam
2.5	Analyze uniform flow computation, flood routing and development of gradually varied flow in an open channel.	S2	Lecture	Assignment, Quiz, Midterm and final exam
2.6	Conduct experiments in the laboratory and evaluate the measurements	S3	Laboratory	Lab assignments and lab exam
3.0	Values, autonomy, and responsibility			
3.1	Demonstrate how to work effectively in diverse groups and professional, ethical, legal and social responsibilities associated	V1	Laboratory	Lab assignments and lab exam



Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	with Laboratory discipline			

C. Course Content

No	List of Topics	Contact Hours
1.	Course Description and Generalities & Introductory Elements	6
2.	Fluids and Their Properties: 1. Introduction to Fluids and Fluid Mechanics 2. Fluid properties – Density, Viscosity, Surface Tension, Capillarity Compressibility and Bulk Modulus, Vapor Pressure and cavitation, 3. Measuring units	12
3.	Hydrostatics 1. Pressure and Pressure Head 2. Pressure Measurement by Manometer 3. Hydrostatic forces on immersed surfaces (Plane and curved) 4. Buoyancy	15
4.	Concepts of Fluid Flow 1. Types of fluid flow – Uniform flow and steady flow; Compressible and incompressible flow; One-, two- and three-dimensional flow 2. Equations of continuity 3. Energy and linear momentum equations 4. Practical applications of the above theories	15
5.	Flow measurement in pipes and pipe network analysis 1. Head Loss in Pipes from Friction (i.e. Major Losses), 2. Turbulent Flow in Circular Pipes 3. Pipe in parallel and pipe in series, 4. Pipe Network Analysis and design	9
6.	Open Channel Flow 1. Properties of open channels 2. Definition of geometric elements of a channel 3. Flow classification, equation of motion and continuity equation 4. Conservation of energy & energy coefficient 5. Uniform flow computations, Chezy & Manning equation 6. Specific energy concept and curve 7. Computation of critical flow 8. Hydraulic jump	12
7.	Hydraulic Structures 1. Functions of hydraulic structures, 2. Dams, functions and classification (Gravity, arch, buttress, earth)	15





	3. Stability of dams 4. Weirs 5. Spillways and their types 6. Culverts (types and hydraulic design) 7. Reservoirs	
8.	Quizzes, Midterm Exam and Lab Exam	6
Total		90

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	2, 5, 8, 11, 14	10%
2.	Quizzes	4, 12	10%
3.	Lab Assignments	2, 5, 8, 11, 14	10%
4.	Midterm Exam	7 or 8	20%
5.	Lab Exam	15	10%
6.	Final Exam	16 or 17	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	Crowe, C. T., Donald, F. E. and John, A. R. (2014). Engineering Fluid Mechanics. USA: John Wiley & Sons
Supportive References	Okiishi, M.Y. (2006). Fundamentals of fluid mechanics .USA : Wiley Fox, R.W., Prichard, P. J. and McDonald, A. T. (2008). Introduction to Fluid Mechanics. USA :Wiley.
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	<ul style="list-style-type: none"> - Classroom with minimum capacity of 25 students - Equipped Fluid Mechanics Laboratory





Items	Resources
Technology equipment (projector, smart board, software)	Projector, whiteboard
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Student	Indirect
	Instructor	Direct
Effectiveness of Students assessment	Student	Indirect
	Instructor	Direct
Quality of learning resources	Student	Indirect
	Instructor	
The extent to which CLOs have been achieved	Instructor	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Civil and Environmental Engineering Department Council in Al-Qunfudah
REFERENCE NO.	The fifteenth session of the academic year 1446
DATE	01/05/2025

