هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Fluid Mechanics**
Course Code:	**2023204-3**
Program:	Bachelor in Mathematics
Department:	Mathematics and Statistics Department
College:	**Faculty of Sciences**
Institution:	**Taif University**
Version:	**1**
Last Revision Date:	**20/05/2023**

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: Level 6/ Third Year					
4. Course general Description:					
The course provides an introduction to fundamental concepts of fluid mechanics. Provides an understanding of potential velocity and vortex. Establishes the equations of motion for viscous and perfect fluids in terms of stress. Introduces the equation of motion for Newtonian fluids if the body force is conservative. Study the motion of the fluid in two dimensions and define the stream function. Study and analyze the complex potential in Cartesian coordinates and polar coordinates. Deduce a complex potential for a source, sink and dipole.					
5. Pre-requirements for this course (if any):					
Mechanics 2022203-4					
6. Co-requirements for this course (if any):					
None					
7. Course Main Objective(s):					

The student will be taught as follows:

- **Introducing the fundamental concepts in fluid mechanics and compare between the incompressible fluid and compressible fluid.**
- **Explaining the velocity potential and the sufficient and necessary conditions for the potential motion, and recognize the motion in two dimensions, stream function, complex potential and Source and Sink.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**3Hr /Week**	100%
2	E-learning		
3	Hybrid • 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**	NA
3.	**Field**	NA
4.	**Tutorial**	NA
5.	**Others (specify)**	NA
Total		**45**

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	Recognize the difference between the steady state and unsteady state.	K2	• Lectures • Group discussions `	• Exams • Assignments
1.2	Outline the differential equation of stream lines and convey the interpret the flow of fluid.	K2	• Lectures • Group discussions	• Exams • Assignments
2.0	**Skills**			
2.1	Demonstrate the difference between the perfect fluid and viscous fluid.	S2	• Interactive classes • Group discussions	• Quizzes • Assignments
2.2	Explain a fundamental physical and mathematical understanding of Fluid	S2	• Lectures • Self-learning through the	• Exams • Quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	mechanics.		website	
2.3	Plan the difference between Newtonian fluid and non-Newtonian fluid.	S2	• Lectures • Group discussions	• Exams • Quizzes • Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	Work effectively within groups and independently.	V1	• Projects	• Through the oral presentation of the projects.
3.2	Articulate ethical behaviour associated with institutional Guidelines in classroom, and in Lab.	V3	• Interactive classes	• Assignments

C. Course Content

No	List of Topics	Contact Hours
1.	Kinematics: fundamental s concepts – velocity and acceleration of fluid particle.	3
2.	Definition of ideal and viscous fluid, incompressible fluid-steady motion. Definition of stream lines and path lines.	3
3.	Differential equation of stream lines and path lines- Derivation of continuity equation - Examples-Equation of continuity for incompressible fluid.	3
4.	Velocity potential – Rotational and irrotational motion-circulation – vortex- Equations of motion: stress tensor.	3
5.	Equation of motion for incompressible fluid in terms stress-Newtonian and Non-Newtonian fluids- Equations of motion for ideal fluid	3
6.	Navier-Stock's equations- applications- - Euler equation- kinetic energy for irrotational fluid	3
7.	**First Midterm exam**	3
8.	Equations of motion of incompressible fluid if the body forces conservative –Applications-Motion in two dimensions –	3
9.	Equations of motion of incompressible fluid if the body forces conservative –Applications-Motion in two dimensions –	3
10.	Applications- Definition of a complex potential -Examples	3
11.	Relations of Cauchy-Rema-n Complex velocity- uniform stream in a straight line-The stream in a right angle.	3
12	Sources and sinks in two dimensions – complex potential of a source in two dimensions.	3

13.	**Second Midterm exam**	3
14.	Doublet in two dimensions. Sources and sinks in two dimensions.	3
15	Complex potential of a source in two dimensions. Doublet in two dimensions.	3
Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes	Continuous Evaluation	10 %
2.	Assignments, report	Continuous Evaluation	10 %
3.	Midterm 1 Exam	8-9	15%
4.	Midterm 2 Exam	12-13	15%
5.	Final Exam	15-16	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	**P. P. Gupta, Hydrodynamics: India (1969).**
Supportive References	**Munson, Yong, Okiishi. Fundamental of Fluid Mechanics(4thEdition)- (2002).**
Electronic Materials	https://en.wikipedia.org/wiki/Fluid_mechanics
Other Learning Materials	**SDL, Calculous programming (Mathematica, Mathcad, Mathlab)**

2. Required Facilities and equipment

Items	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**Classrooms, which can accommodate up to 50 students and equipped with e-podiums, and internet access.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**Laptop, smart board and projector.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	**Wi-Fi internet connectios**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching and assessment	Students	Indirect
Quality of learning resources	Peer Reviewer Students	Direct & Indirect
Extent of achieving the course learning outcomes	Peer Reviewer Students	Direct & Indirect
Other		

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Department Council
REFERENCE NO.	4
DATE	October 2023

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