هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Fluid Mechanics**
Course Code:	**464 Math**
Program:	**B. Sc. in Mathematics**
Department:	**Mathematics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours:	
2. Course type	
a. University ☐ College ☐ Department ☑ Others ☐	
b. Required ☑ Elective ☐	
3. Level/year at which this course is offered: Level 8/Year 4	
4. Pre-requisites for this course (if any)**: 434 MATH**	
5. Co-requisites for this course (if any)**:** **None**	

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	45	100%
2	**Blended**		
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	42
2	**Laboratory/Studio**	
3	**Tutorial**	3
4	**Others** (specify)	
	Total	45

B. Course Objectives and Learning Outcomes

1. Course Description

- Introduction, Fluid Concept, Fluid Continuum, Lagrangian Description, Eulerian Description, Acceleration Field, Material Derivative, Streamlines, Path lines, Kinematic Description, Rate of Translation and Rotation, Linear Strain Rate, Shear Strain Rate, Vorticity Rotationality
- The Stream Function and the Velocity Potential Function - Complex potential function, Irrotational Flow, Plane Potential Flows, Uniform Flow, Source and Sink Flow, Vortex flow, Circulation around various paths in a free vortex, The combination of a source and sink of equal strength located along the x axis (Doublet).
- Conservation of Mass, Differential Form of Continuity Equation, Cylindrical Polar Coordinates, The Stream Function, Inviscid Flow, Euler's Equations of Motion, The Bernoulli Equation, Irrotational Flow, The Bernoulli Equation for Irrotational Flow

Description of Forces Acting on Differential Element, Equations of Motion, Inviscid Flow, Euler's Equations of Motion, The Bernoulli Equation, The Navier

2. Course Main Objective

After finishing the course, the student is expected to be familiar with the following:

- Solving problems and proves theorems on Fluid Kinematics.
- Solving problems and proves theorems on Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation.

Solving problems and prove theorems on Complex potential function

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Distinguishing mathematical concepts relevant to Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	K1
1.2	Identify background science, features and structure of mathematical problem in Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	K2
1.3	Explain notations and concepts required for the solution of Mathematical problem in Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	K3
2	**Skills :**	
2.1	Apply theoretical, computational or practical aspect relevant to Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	S1
2.2	Compute numerical quantities for various parameters to approximate the solution in Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	S2
2.3	Apply various mathematical rules, techniques and theorems in Application on Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	S3
2.4	Solve mathematical problem using critical thinking in Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	S4
3	**Values:**	
3.1	Cultivate a mathematical attitude and nurture the interest.	V1
3.2	Realize the importance of responsibilities through different modes of	V2

CLOs		Aligned PLOs
	practice, competition and related activities.	
3.3	Inculcating values and ethics in thought, expression and deed.	V3

C. Course Content

No	List of Topics	Contact Hours
1	Fluid Concept	9
2	The Stream Function and the Velocity Potential Function	9
3	Conservation of Mass, Differential Form of Continuity Equation,	9
4	Chi-square tests	9
5	Description of Forces Acting on Differential Element, Equations of Motion	9
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	Distinguish mathematical concepts relevant to Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	Lectures, Web based work, Classroom discussions	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
1.2	Identify background science, features and structure of mathematical problem in Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.		
1.3	Explain notations and concepts required for the solution of Mathematical problem in Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.		
2.0	**Skills**		
2.1	Apply theoretical, computational or practical aspect relevant to Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.	Lectures, problem solving, web based work, Classroom discussions.	Written exam (Problem solve, MCQ, true/false, Proof, Short answer), Quizzes, Assignments
2.2	Compute numerical quantities for various parameters to approximate the solution in Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.		
2.3	Apply various mathematical rules, techniques and theorems in Application on Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential function.		
2.4	Solve mathematical problem using critical thinking in Fluid Kinematics-Euler`s, Lagrangian`s Methods, Continuity Equation, Velocity Potential, Vorticity. Motion of Incompressible Fluid: Stress Tensor, Navier Stokes`s Equations, Boundary Conditions, Bernoulli`s Equation, Euler`s Equation, Stream, potential functions and Complex potential		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
	function.		
3.0	**Values**		
3.1	Cultivate a mathematical attitude and nurture the interest.	Group work, problem solving, web based work	Assignments
3.2	Realize the importance of responsibilities through different modes of practice, competition and related activities.		
3.3	Inculcating values and ethics in thought, expression and deed.		

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Homework	3	5%
2	First exam.	6	20%
3	Second exam.	12	20%
4	Homework	14	5%
5	Final exam.	16	50%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students assigned to a member of staff who will be available for help and academic guidance office hours at specific hours on daily basis. At least be available 8 hours per week.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	A Brief Introduction to Fluid Mechanics, 3rd Edion, Young, Wiley 2007.
Essential References Materials	**Web sites dedicated to Fluid Mechanics available on the internet**
Electronic Materials	Web sites dedicated to Statics on the internet
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Classroom, Computer Lab.

Item	Resources
Technology Resources (AV, data show, Smart Board, software, etc.)	Smart Board , Data Show, Mathematical software
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (Course Evaluation Survey)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Board Of Mathematics Department**
Reference No.	**12th Meeting Of The Board Of Mathematics Department 1441-1442**
Date	**14/6/1442 A. H.; 27/1/2021 A. D.**