

SULTAN QABOOS UNIVERSITY COURSE OUTLINE

PROGRAM: Water Technology, Agricultural Engineering

| 1. Course Code | SWAE3310 | |
|-----------------------------|---------------------------------|---------------------------------|
| 2. Course Title | Fundamentals of Fluid Mechanics | |
| 3. Credits | 3 CR, 12 CP, 6 ECTS | |
| 4. Pre-requisite Course(s) | MATH2107, PHYS(2101 or 2107) | |
| 5. Co-requisite Course(s) | N/A | |
| 6. Equivalent Course(s) | N/A | |
| 7. Incompatible Course(s) | N/A | |
| 8. Course Category | University Requirement | University Elective |
| | College Requirement | College Elective |
| | Department Requirement | Department Elective |
| | Specialization Requirement | Specialization Elective |
| | Other (specify): | |
| 9. Course Owner | College: CAMS | Department: SWAE |
| 10. Course Type | | Lecture/Lab |
| | Lecture/Seminar | Lecture/Studio |
| | Lecture/Tutorial | Lecture/Lab/Tutorial or Seminar |
| | Tutorial | Laboratory (Practical) |
| | Field or Work Placement | Studio |
| | Seminar | Internship |
| | Workshop | Project |
| 11. Language of Instruction | English | |

12. Course Description

The objectives of this course are to give the student a fundamental knowledge of practical mechanics of liquids and gases. It will teach how the basic laws of newtonian mechanics are applied fluid's engineering of dams, reservoirs, pipes, channels and other fluid conveying-storing entities. The distinction between Newtonian and non-Newtonian fluids is considered from the view point of basic rheology and liquids used in irrigation (water, brine), industries (oils, polymers, food substances). In fluid statics students learn the distributions of pressures, forces and moments on submesrsed surfaces and bodies, as well as basics of floatation and buoyancy phenomena. In fluid dynamics, the focus is on ideal fluids and Bernoulli's and Eulaer equations as applied to calculations of the flow rates and pressure variations. The Reynolds transport theorem is the core of the control volume chapter. The fluids kimenatics deals with the fields of velocity and acceleration, introducing the concepts of streamlines, trajectories, streaklines and the concepts of Eulerian and Lagarangian description of fluids' motion. The basics of similitude and analysis of dimensions are involved via the application of the Buckingham theorem.

13. Teaching/Learning Strategies

laboratory conditions, (b, c, d, i)

3. How the management functions of fluid engineering tools are integrated in the application to industrial and farm operations of fluid-relevant entities (f, h).

| 14. Assessment Components and Weight [%] | | | | | |
|--|-----------------------|------------------|--|--|--|
| Quizzes 20% | Practical 15% | Other (specify): | | | |
| Homework assignments | Project | | | | |
| \square In-term examination(s) 25% | Final examination 40% | | | | |

| 15. Grading Method |
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| A-F Scale Pass/Not passed |
| 16. Textbook(s) and Supplemental Material |
| Main Textbook: |
| Munson B. R., Young D.F., Okiishi T.H. Fundamentals of Fluid Mechanics |
| Wiley, N.Y. |
| Supplementary Textbook: |
| Fox R.W., McDonald A.T. Introduction to Fluid Mechanics |
| Compulsory Video Materials: The National Committee (USA) for Fluid Mechanics Films: |
| 1. Rheological Behaviour of Fluids |
| 2. Pressure Fields and Fluid Acceleration |
| 3. Eulerian and Lagrangian Descriptions in Fluid Mechanics |
| 4. Low-Reynolds-Number Flows |
| 5. Vorticity (part 1) |
| 6. Curious Drag Experiments (part 1) |
| 7. Waves in Fluids (optional, depends on holidays-Eid pattern) |
| Several videoclips from the Munson et al. textbook |

| 17. | 17. Matching Course Objectives with Program Outcomes and SQU Graduate Attributes | | | | | |
|----------------|--|----------|---|----|--|--|
| | SQU Graduate Attributes | | | | | |
| A. | SQU graduates should be able to: | В. | SQU graduates possess | C. | SQU graduates should | |
| 1. 2. 3. | apply the knowledge and skills relevant to the specialization communicate effectively and use information and communication technologies critically analyze complex | 1. 2. | interpersonal communication skills and alignment with culture of international labour market to assist them in practical life and in living successfully skills and motivation for independent learning and engagement in lifelong | | relish good citizenship qualities, be conscious of their national identity and be socially responsible, engage in community affairs and | |
| | information and present it in simple clear manner | 3. 4. | learning and research work ethics and positive values, and intellectual independence and autonomy teamwork skills and display potential leadership qualities | | be mindful of contemporary issues. | |

| # | Intended Student Learning Outcome /Course Learning Objective | Relevant Program Outcome(s) | Applicable Attribute(s) |
|----|---|---|---|
| 1. | Understand various functional systems and operational behavior of fluid containing and conveying systems | a. An ability to apply knowledge of mathematics, science, and engineering. | ABET (a, b, c, j, k) SQU A1,A3 |
| 2. | Understand and interprit how the engineering fundamentals and theory applied to operations of fluid mechanics systemes and equipment under laboratory conditions | b. An ability to design and conduct experiments, as well as an ability to analyze and interpret data. | ABET (b, c, d, i) SQU A1, A2, A3 |
| 3. | Understand how the management functions integrate in the application of fluid mechanics to industrial and on-farm activities involving fluids. | c. An ability to design a system, component, or process to meet desired needs. | ABET (f, h) SQU A1, A3 |
| 4. | | d. An ability to function on multi- disciplinary teams. | |
| 5. | | e. An ability to identify, formulate and solve engineering problems. | |

| 6 | f. An understanding of pr | ofessional and |
|-----|--------------------------------|------------------|
| 0. | ethical responsibility. | |
| 7. | g. An ability to communica | te effectively. |
| | h. The broad education | necessary to |
| 8. | understand the impact of | of engineering |
| | solutions in a global and soc | eietal context. |
| 0 | i. A recognition of the ne | ed for, and an |
| 9. | ability to engage in life-long | g learning. |
| 10. | j. The knowledge of contem | porary issues. |
| | k. An ability to use the tec | hniques, skills, |
| 11. | and modern engineering too | ls necessary for |
| | engineering practice | |
| 12. | | |
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16. Student Responsibilities

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirement and students' academic code of conduct.

For attendance, it is the student's responsibility to be punctual and to attend all classes.

Students are expected to perform their work with honesty and avoid any academic misconduct, which is defined as the use of any dishonest or deceitful means to gain some academic advantage or benefit. This can take many forms, including but not limited to, the following: copying, plagiarism, collusion and forging documents. For full details, please refer to the Undergraduate Academic Regulations and to the Student Academic Misconduct Policy.

Additionally, this course requires that you:

Students should be aware of and abide by all University Regulations

1. Attendance: Class attendance is mandatory according to the University regulations.

2. No make-up exams will be given without a written medical excuse or prior permission from the instructor.

3. Students are responsible for all materials covered in the class whether presented orally during lectures or assigned from the text.

4. No class assignment of any student will be graded once the same assignment is corrected and returned to the class.

Assignment and Lab report submissions: within one week

Examinations: Class examinations will cover class material, homework assignments, and assigned readings.

| COURSE INFORMATION | | | | | |
|---|--|--|--|--|--|
| Course Code | SWAE3310 Course Title Fundamentals of Fluid Mechanics | | | | |
| Semester/ Year | FallSection(s)10/11 | | | | |
| Day, Time, and Place | As in master timetable. Lab will be AGR0016 and Civil engineering- Petroleum Engineering Labs, College of Engineering. | | | | |
| Course Coordinator | Course Coordinator Dr. Anvar Kacimov | | | | |
| Office Location Room 237 Office Hours As mentioned in the timetable | | | | | |
| Office Tel. Ext. 1227 Email anvar@squ.edu.om | | | | | |

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| Tentative Schedule | | | | | |
|--------------------|-----------|---|-------------------|--|--|
| Week | Lecture # | Topic/Material to be covered | Assessment | | |
| 1 | 1 | Basic Newtonian Mechanics, Properties of Liquids and Gases | | | |
| 2 | 2.1 | Dimensions and Units, Homogeneity Principle and Conversion Rules | Lab #1 | | |
| | | Lab #1 (Rolling cylinders and flow through orifice) | | | |
| 3 | 3.1 | Principles of Fluid Statics | | | |
| | | Basic Rheology | Lab #2 Quiz #1 | | |
| | | Lab #2 (Viscometry) | | | |
| 4 | 3.2 | Pascal's law and Manometry | | | |
| 5 | 3.2 | Archimedes Law and Buoyancy | | | |
| | | Lab #3 (Quadrant experiments, forces and moments acting on planar surfaces) | Lab #3 | | |
| 6 | 4 | Bernoulli's equation | Quiz #2 | | |
| 7 | 5.1 | Applications of Bernoulli's equation | Lab #4 | | |
| | | Lab # 4 (Venutri sections) | | | |
| 8 | 5.2 | Fluids' kinematics | Mid-semester exam | | |
| 9 | 6.1 | Applications of Control Volume Concepts | Lab #5 | | |
| | | Lab #5 (Drag force acting on vanes) | | | |
| 10 | 6.2 | Differential Analysis of Fluid Flow | | | |
| 11 | 7 | Similitude, Buckingham Theorem | Lab #6 | | |
| | | Lab #6 (Stokes' sedimenation) | | | |
| 12 | 8 | Principles of Physical and Mathematical (CFD) Modelling | | | |
| 13 | 9 | Viscous Flow in Pipes | Lab #7 | | |
| | | Lab #7 (Friction Apparatus) | | | |
| 14 | 10 | Drag and Lift for External Flows | Quiz #3 | | |
| 15 | 11 | Low Reynolds Number Flows and Applications to Flow Through Porous | | | |
| | | Media | | | |
| 16 | | | Final Exam | | |
| 17 | | | | | |

| APPENDIX A: INSTRUCTORS OF MULTIPLE SECTIONS | | | | | | |
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| Section | Instructor | Day, Time, and Place | Office Location and Extension | Email | Office Hours | |
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APPENDIX B: ADDITIONAL INFORMATION