Module Information
CE50031 Hydrodynamics of Fluid-Structure Interaction
Semesters 1 and 2, 2019-2020 Academic Year

Module Instructor
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Semester 1 Class Schedule

- **Lectures:**
  Weeks 1-4, 8-12, Monday, 04:00PM - 05:00PM at Fulton H2
  Weeks 1-4, 8-12, Thursday, 11:00AM - 12:00PM at Fulton H2
- **Tutorials:** Weeks 3, 4, 8 and 10, Wednesday, 02:00PM - 03:00PM at Fulton H2
- **Laboratory:** Weeks 8-12, Thursday, 11:00AM - 01:00PM at Fulton F13, Fluid Mechanics Lab

Semester 2 Class Schedule

- **Lectures:**
  Weeks 15-25, Monday, 01:00PM - 02:00PM at Fulton H2
  Weeks 15-25, Thursday, 11:00AM - 12:00PM at Harris LT
- **Tutorials:** Weeks 17, 19, 21 and 23, Wednesday, 02:00PM - 03:00PM at Fulton H2
- **Laboratory:** Weeks 18-22, Thursday, 09:00AM - 11:00AM at Fulton F13, Fluid Mechanics Lab

Office Hours

Wednesday: 12:00PM-01:00PM
Thursday: 12:00PM-01:00PM
And by appointments.

Grading

Written Assignments (about six over the year) *	30%
Laboratory Assignments (about two over the year)*	10%
Final Examination **	60%

* The minimum pass mark for the combined coursework is 30%.
** The minimum pass mark for the final examination is 30%.

Grading Scale

A	$\geq 70\%$
B	$\geq 60\%$
C	$\geq 50\%$
D	$\geq 40\%$
F	$< 40\%$

For more information see:
https://www.dundee.ac.uk/governance/policies/policy-taught-provision/

REFERENCES

Textbooks

- Newman, John N. (1977), Marine Hydrodynamics, The MIT Press, 432 pp., ISBN: 978-0262140263.
- Batchelor, G.K. (2000), An Introduction to Fluid Dynamics, Cambridge University Press, 658 pp., ISBN: 978-0521663960
- Kundu, Pijush K., Cohen, Ira M., Dowling, David R. (2011), Fluid Mechanics, Academic Press; 5 edition, 920 pp., ISBN: 978-0123821003.
- Currie, I.G. (2012), Fundamental Mechanics of Fluids, CRC Press, 603 pp., ISBN 978-1439874608
- Chakrabarti, S.K. (2003), Hydrodynamics of Offshore Structures, WIT Press / Computational Mechanics, 464 pp., ISBN: 978-0905451664.
- Sarpkaya, Turgut and Isaacson, Michael (1981), Mechanics of Wave Forces on Offshore Structures, Van Nostrand Reinhold Company; First edition, 651 pp., ISBN: 978-0442254025.
- Le Méhauté, Bernard (1976), An Introduction to Hydrodynamics and Water Waves, Springer Berlin Heidelberg, 322 pp., ISBN: 978-3-642-85569-6
- Lighthill, James (2001), Waves in Fluids (Cambridge Mathematical Library Series), Cambridge University Press; 2 edition, 524 pp., ISBN: 978-0521010450.
- Dean, Robert G. and Dalrymple, Robert A. (1991), Water Wave Mechanics for Engineers & Scientists (Advanced Series on Ocean Engineering-Vol. 2), World Scientific Pub Co Inc, 353 pp., ISBN: 978-981-02-0421-1.
- Whitham, G. B. (1999), Linear and Nonlinear Waves, Wiley-Interscience, 660 pp., ISBN: 978-0471359425.

Online References

- Journée, J.M.J. and Massie, W.W. (2001), Offshore Hydromechanics, Delft University of Technology, First Edition, 570 pp., available online at `http://www.shipmotions.nl/DUT/LectureNotes/OffshoreHydromechanics.pdf`.
- Le Mehaute, B. (1976), An introduction to hydrodynamics and water waves, Springer-Verlag Berlin Heidelberg, 323 pp., 978-3-642-85567-2. `https://repository.library.noaa.gov/view/noaa/10669/noaa_10669_DS1.pdf`.
- Dhanak, M. R. and Xiros, N. I. (Eds.), (2016). Springer Handbook of Ocean Engineering, Springer, 1345 pp., ISBN 978-3-319-16649-0. `http://www.springer.com/gb/book/9783319166483`. (Available to UoD students free of charge through the library links.)

MODULE COMMUNICATIONS

Module-related material, along with class communications, are held on *My Dundee* portal and communicated through Emails. Students are expected to check their emails and to use the module webpage regularly. All required material should be downloaded from My

Dundee and stored locally; access to the module page will not be extended beyond the current academic year.

Module Aims

The aim of this module is to enable individuals to analyse the theoretical and experimental principles of fluid-structure interaction problems in ocean engineering, and to develop and extend understanding of engineering principles as they relate to the design of floating or fixed structures in the oceans.

Intended Learning Outcomes

On completion of this module students should be able to:

- clearly understand and explain the principles of the motion of viscous and ideal fluids and laminar and turbulent boundary layers in fluid mechanics,
- demonstrate a comprehensive understanding of linear and nonlinear water wave theories and analyse the kinematics, dynamics and propagation properties of water waves,
- critically assess the applicability of different analytical and empirical approaches in calculating wave and current loads on structures,
- concisely formulate the diffraction, radiation and motion of floating and submerged bodies in deterministic and irregular waves,
- be equipped to design offshore structures for extreme ocean conditions,
- develop effective self-learning skills.

Prerequisites

CE40006 Environmental Hydraulics or equivalent background.

Attendance Polices

The module content will be primarily discussed in class. Some (and NOT all) module material will be made available online through *My Dundee* portal. It is assumed that students will attend all lectures and tutorials, and take notes of the material written on the board and discussed in class.

Final Examination:

The final examination of this module will be given at the end of Semester 2. The University of Dundee Semester 2 examinations will take place 27 April – 29 May 2020. Exact day and time of this module's examination will be set and announced by the University prior to the examination month.

Semester 1
Tentative
Schedule

Monday	Wednesday	Thursday
Sep 16th **1** Module Introduction	18th **2**	19th **3** Indicial Notation & Cartesian Tensors
23rd **4** Dimensional Analysis	25th **5**	26th **6** Dimensional Analysis
30th **7** Viscous Fluid Motion	Oct 2nd **8** Tutorial I	3rd **9** Viscous Fluid Motion
7th **10** Viscous Fluid Motion	9th **11** Tutorial II	10th **12** Ideal Fluid Motion
14th **13**	16th **14**	17th **15**
21st **16**	23rd **17**	24th **18**
28th **19**	30th **20**	31st **21**
Nov 4th **22** Ideal Fluid Motion	6th **23** Tutorial III	7th **24** Ideal Fluid Motion
11th **25** Linear Wave Theory	13th **26**	14th **27** Linear Wave Theory
18th **28** Dispersion Relation	20th **29** Tutorial IV	21st **30** Particle Kinematics and Dynamics
25th **31** Particle Kinematics and Dynamics	27th **32**	28th **33** Wave Power and Energy

Semester 2 Tentative Schedule

Monday	Wednesday	Thursday
Jan 20th **1** Nonlinear Wave Theories	22nd **2**	23rd **3** Irregular Waves
27th **4** Irregular Waves	29th **5**	30th **6** Irregular Waves
Feb 3rd **7** Elementary Singularities	5th **8** Tutorial I	6th **9** Elementary Singularities
10th **10** Elementary Singularities	12th **11**	13th **12** Wave Diffraction
17th **13** Wave Diffraction	19th **14** Tutorial II	20th **15** Wave Diffraction
24th **16** Wave Loads	26th **17**	27th **18** Wave Loads
Mar 2nd **19** Hydroelasticity	4th **20** Tutorial III	5th **21** Wind and Current Loads
9th **22** Floating Bodies	11th **23**	12th **24** Floating Bodies
16th **25** Floating Bodies	18th **26** Tutorial IV	19th **27** Floating Bodies
23rd **28** Random Responses	25th **29**	26th **30** Random Responses & Exam Review