University of Dundee

CE50031 Hydrodynamics of Fluid-Structure Interaction *MODULE GUIDE and SYLLABUS*

MODULE INFORMATION

CE50031 Hydrodynamics of Fluid-Structure Interaction
Semester 1 and 2, 2017-2018 Academic Year

MODULE INSTRUCTOR

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SEMESTER 1 CLASS SCHEDULE

- **Lectures:**
  Weeks 1-12, Monday, 04:00PM - 05:00PM at Fulton H2
  Weeks 1-3, 5-7, 9, 11-12, Wednesday, 02:00PM - 03:00PM at Fulton H2
  Weeks 4, 8, 10, Wednesday, 04:00PM - 05:00PM at Fulton H2

- **Tutorials:** Weeks 4, 6, 8 and 10, Friday, 11:00AM - 12:00PM at Fulton H2
- **Laboratory:** Weeks 6-12, Thursday, 2:00PM - 04:00PM at Fulton F13, Hydraulics Lab

OFFICE HOURS

Monday:	03:00PM-04:00PM
Wednesday:	03:00PM-04:00PM
Friday:	03:00PM-04:00PM

And by appointments.

GRADING

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

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.
- Lighthill, James (1993), Fundamental Mechanics of Fluids, McGraw-Hill, Second Edition, 454 pp., ISBN 0-07-113242-2

- 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 Mhaut, 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

- Journe, 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. Students are expected to check and 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 Semester 2 examinations will begin on 23/04/2018 and ends 25/05/2018. 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
Sep 11th **1** Module Introduction	13th **2** Preliminaries
18th **3** Indicial Notation	20th **4** Cartesian Tensors
25th **5** Dimensional Analysis	27th **6** Viscous Fluid Motion
Oct 2nd **7** Viscous Fluid Motion	4th **8** Viscous Fluid Motion
9th **9** Viscous Fluid Motion	11th **10** Viscous Fluid Motion
16th **11** Ideal Fluid Motion	18th **12** Ideal Fluid Motion
23rd **13** Ideal Fluid Motion	25th **14** Ideal Fluid Motion
30th **15** Linear Wave Theory	Nov 1st **16** Linear Wave Theory
6th **17** Linear Wave Theory	8th **18** Particle Kinematics and Dynamics
13th **19** Particle Kinematics and Dynamics	15th **20** Particle Kinematics and Dynamics
20th **21** Wave Power and Energy	22nd **22** Nonlinear Wave Theories
27th **23** Reading Day; No Class	29th **24** Reading Day; No Class

Semester 2
Tentative
Schedule

Monday	Tuesday
Jan 15th **1** Module Review	16th **2** Module Review
22nd **3** Wave Diffraction	23rd **4** Wave Diffraction
29th **5** Wave Diffraction	30th **6** Wave Diffraction
Feb 5th **7** Wave Loads	6th **8** Wave Loads
12th **9** Wave Loads	13th **10** Wave Loads
19th **11** Wind and Current Loads	20th **12** Wind and Current Loads
26th **13** Hydroelasticity	27th **14** Hydroelasticity
Mar 5th **15** Floating Bodies	6th **16** Floating Bodies
12th **17** Floating Bodies	13th **18** Floating Bodies
19th **19** Random seas	20th **20** Random seas
26th **21** Transfer functions for responses	27th **22** Transfer functions for responses
Apr 2nd **23** **Degree Exam Review**	3rd **24** Reading Day; No Class