

Momentum, Heat and Mass Transport 315039
Dr. Fabian Rios – Spring Semester 2021

Prerequisites: 315051

Syllabus:

Part One – Fluid Mechanics

1. Fluid Mechanics Introduction
2. Statics
3. Conservation, Integral
4. Conservation, Differential
5. Internal Viscous Flow
6. External Viscous Flow

Part Two – Heat & Mass Transfer

7. Introduction to Heat Transfer
8. Conduction
9. 1-D, Steady State Conduction
10. Non 1-D, and Non-Steady State Conduction
11. Convection
12. Boundary Layer Similarity
13. External and Internal Flow
14. Free Convection, Boiling and Condensation

Course Topics:

Introduction to fluid mechanics, control volume, continuum, fluid flow and visualization, types of fluids, fluid statics, conservation laws integral and differential, Navier-Stokes, Bernoulli, Euler, forces acting on a fluid, similarity, laminar and turbulent flow, Reynolds number, external viscous flow, drag and lift, friction and pressure drag, drag coefficient, boundary layer, coefficient of skin friction, external turbulent flow, internal viscous flow, major and minor losses, Moody diagram, internal turbulent flow .

Heat transfer, conduction, convection, radiation, conservation of energy on a surface, Fourier's Law, thermal conductivity in solids, liquids and gases, thermal diffusivity, Heat Equation, steady and unsteady state conduction, Lumped Capacitance Model, Biot and Fourier numbers, heat equation solutions 1D, 2D, 3D, forced convection, convection coefficient (heat and mass), thermal and concentration boundary layers, laminar and turbulent flow, boundary layer equations, Prandtl, Schmidt, Nusselt and Sherwood numbers, boundary layer analogies, external and internal flow, free convection, boiling and condensation.

Textbooks:

- P. J. Pritchard and J. W. Mitchell; Fox's and McDonald's Introduction to Fluid Mechanics.
- F. P. Incropera, D. P. DeWitt, T. L. Bergman and A. S. Lavine; Incropera's Principles of Heat and Mass Transfer.
- J. R. Welty, C. E. Rorrer and D. G. Foster; Fundamentals of Momentum, Heat and Mass Transfer.

Lecture (10):

Sunday, 9:30 - 12:30, Classroom – TBD

Tutorials:

Group 11: Monday, 12:30 - 14:30, Classroom -TBD

Group 12: Tuesday, 10:30 - 12:30, Classroom -TBD

In case of on-line learning, classes (lectures and tutorials) will be given by Zoom-live at the same specified days and time.

Exams:

Term A: 4/8/21 Time: TBD

Term B: 3/10/21 Time: TBD

Class Exam Guidance:

Duration: Three Hours

Allowed Material:

- Dr. Fabian Rios lecture slides (Hardcopy only).
- Reasonable sized notes in the lecture slides allowed.
- You can print the slides the size you like (for example if you want a graph or a table in a full size page).
- 4 equation pages (2 sheets).
- Differentials and Integrals booklet.
- Standard hand calculator.

Not Allowed Material:

- Electronic equipment of any sort with exception of the hand calculator.
- Books of any sort.
- Notes or slides of any sort, outside those described in allowed.
- Cannot bring separated pages with notes. Only around the allowed slides.
- Tutorial notes, solved examples from class, tutorials or homeworks.
- Solved examples of any sort.
- Any unsuitable material will be taken away.

On-line Exam Guidance:

In case of on-line exams, they will be performed at the same specified days and time. Rules regarding on-line exams will be published by the university if needed, in due time.

Duration: Three Hours

Allowed Material: All printed material.

Not allowed material: All electronic material.

Office Hours:

Sunday, 8:30 – 9:15. Sunday 12:30 - 13:30, Tuesday 12:30 -13:30 - Room 626, De-Jour Building.

Questions can be sent by mail to rfabian@technion.ac.il 24/7. Replies within 24 hours (Not including Saturdays).

In case of on-line learning, Zoom Office Hours will be determined if needed.

Grading:

- Homework – Mandatory Submission - 10%
- Submitted in 1 week, unless otherwise specified.
- Homeworks are submitted in the Moodle in the respective task field.
- Homeworks are graded: pass (100) or fail (0).
- No corrections will be marked in the Homeworks. Homeworks will be solved in class or otherwise the solution will be posted in the Moodle.
- All homeworks have equal grading amounting to 10% of final grade.

- Exam - 90% of final grade