INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

DPT GENIE ENERGETIQUE ET ENVIRONNEMENT
ENERGETICS AND ENVIRONMENTAL ENGINEERING
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# Heat Transfer

## Heat convection

### IDENTIFICATION

CODE : GEN-3-S1-EC-CONV
ECTS : 2.0

### HOURS

| | |
|---|---|
| Lectures : | 9.0 h |
| Seminars : | 6.0 h |
| Laboratory : | 8.0 h |
| Project : | 0.0 h |
| Teacher-student contact : | 23.0 h |
| Personal work : | 20.0 h |
| Total : | 43.0 h |

### ASSESSMENT METHOD

1 written exam

### TEACHING AIDS

short book with the main equations (in english)

### TEACHING LANGUAGE

French

### CONTACT

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### AIMS

Determination of natural and forced single-phase heat transfer coefficients. Determination of pool boiling heat transfer coefficients.

### CONTENT

1 Introduction
1.1 Fundamental principles
1.2 Physical phenomena
1.3 Various classes of convection problems
2 Single-phase forced convection
2.1 Dimensional analysis
2.2 Relevant variables in convection
2.3 Forced external convection (laminar or turbulent)
2.4 Forced internal convection (laminar or turbulent)
3 Single-phase free (natural) convection
3.1 Free convection problems classification
3.2 Heat transfer coefficient
3.3 Dimensionless numbers and characteristic scales
3.4 Free convection over a vertical flat plate
3.5 Free convection over a horizontal plate (constant temperature)
3.6 Free convection over horizontal cylinders/spheres
4 Boiling and Condensation
4.1 Liquid-vapor phase-change heat transfer: boiling
4.2 Vapor-liquid phase-change heat transfer: condensation

### BIBLIOGRAPHY

Fundamentals of Heat and Mass Transfer. F. P. Incropera, D. P. Dewitt, T. L. Bergman, A. S. Lavine. Editions Wiley. ISBN-13: 978-0-471-45728-2. ISBN-10: 0-471-45728-0.

Convection Heat Transfer. A. Bejan. Editions Wiley. ISBN-13: 978-0-4712-7150-5. ISBN-10: 0-4712-7150-0.

### PRE-REQUISITE

Heat conduction
Differential equations
Basic thermodynamics