University of Brasília
Mechanical Science Graduate Program

Unit information

Program	Mechanical Science (53001010053P0)
Course unit	ADVANCED HEAT TRANSFER
Unit code	PCMEC0144
Unit number	0144
Credit points	4
Period	
Professor	Taygoara Felamingo de Oliveira
Prerequisites	No

Unit outline

Objective:

Provide a solid conceptual foundation of heat conduction and heat convection, and develop techniques for modeling and solving heat transfer problems, as well. At the end of the course, the student should be able to propose mathematical models representing heat transfer processes and determine solutions for these models.

Purpose:

This is a basic training course for students who will develop their dissertations or thesis on topics related to, or that make use of, heat transfer, especially those who develop their work in the field of energy and environment.

Contents:

Fundamentals of Heat Transfer: Laws of conservation of mass and linear momentum for a fluid flow; First and second laws of Thermodynamics; Thermodynamic relations; Constitutive equations; Entropy production; Summary of the governing equations for conduction and convection; **Heat conduction:** Lumped, integral and differential formulations; thermal resistance, cylindrical systems, heterogeneous solids and the Kirchhoff method; solution in power series: the Bessel functions; multidimensional permanent conduction and transient one-dimensional conduction: separation of variables and orthogonal functions; Transient conduction: Laplace transform (guided study); Variational methods. Variational calculus, Ritz method, Kantorovich method; **Convection:** Quasi-parallel flows. Boundary layers, Kármán-Pohlhausen methods, approximate solutions; Similarity transformations, Blasius solution; Parallel flows in steady state. Development length, energy balance and temperature profile; Natural convection. The Boussinesq Hypothesis. Approximate solutions to natural convection problems.

Assessment

Homework (4**0% of the grade)** – Guided self-studies (**30% of the grade)**; Final Exam **(30% of the grade)**

Obs:

Reference:

1) Lienhart and Lienhart**,** A heat Transfer Textbook, Dover, 2019

2) Adrian Bejan, Convection heat transfer, Wiley, 2013;

3) Vedat S. Arpaci, Conduction heat transfer, Addison-Wesley, 1966;

4) Vedat S. Arpaci and Poul S. Larsen, Convection heat transfer, Prentice-Hall, 1984;