Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER 2019-2020

Course Handout Part II

Date: 29/11/2019

In addition to Part-I (General Handout for all courses appended to the time table), this portion gives further specific details regarding the course.

Course No.	: ME G534
Course Title	: CONVECTIVE HEAT AND MASS TRANSFER
Instructor-in-Charge	: JEEVAN JAIDI
Instructors	: Jeevan Jaidi

Course Description:

Conservation equations, boundary layers, free convection, forced convection. Heat transfer in laminar and turbulent, internal as well as external flows, mixed convection. Combined convection and radiation. Boiling and Condensation. Molecular diffusion in fluids, mass transfer coefficient. Simultaneous heat and mass transfer; Applications.

1. Scope and Objective of the Course:

This course has been designed to discuss various modes of convective heat transfers possible in real time applications coupled with relevant theories. It covers possible combinations of laminar and turbulent flows, internal and external flows, and natural and forced convection with mass transfer aspects.The course primarily covers the following topics: Concepts and heatlines; Laminar external flow, similarity solutions; Laminar duct flow, developing and fully developed flow; External natural convection, mixed convection; Natural convection in enclosures; Turbulent boundary layer flow, Mixing-Length model, external flows; Turbulent duct flow, friction factor and pressure drop, heat transfer coefficient; Convection during condensation and boiling; Mass transfer.

2. Text Book (TB):

a. A. Bejan, *Convective Heat Transfer*, Wiley India Pvt. Ltd, Third Edition, 2004.
b. W. M. Kays, M. E. Crawford, and B. Weigand, *Convective Heat and Mass Transfer*, McGraw-Hill Int. Edition, Fourth Edition, 2005.

3. Reference Book (RB):

a. RB1: S. Kakac and Y. Yener, *Convective Heat Transfer*, CRC Press, Second Edition, 1995.
b. RB2: J. G. Collier, and J. R. Thome, *Convective Boiling and Condensation*, Oxford University Press, Third Edition, 1996.

4. Course Plan:

Lecture No.	Learning objectives	Topics to be covered	Chapter/ Section
1-2	Fundamental Principles	Conservation equations, Rules of scale analysis, and Heatlines for visualization.	TB1: 1.1 – 1.6
3-8	Laminar Boundary Layer Flows	Concept of boundary layer, Velocity and thermal boundary layers, Integral solutions, Similarity solutions, Other wall heating conditions, and Flow past a wedge and stagnation flow.	TB:1 2.1 – 2.7
9-14	Laminar Duct Flow	Hydrodynamic entrance length, Fully developed flow, Pressure drop, Heat transfer in developing and fully developed duct flows.	TB:1 3.1 – 3.5
15-19	External Natural Convection	Introduction to Natural convection, Laminar boundary layer equations, Scale analysis, Integral and Similarity solution, Uniform heat flux, Mixed convection, and Heat transfer with turbulence effects.	TB:1 4.1 – 4.6; & 4.10 – 4.11
20-23	Internal Natural Convection	Transient heating from the side and Enclosures heated from below.	TB:1 5.1; & 5.4 – 5.5
24-27	Turbulent Boundary Layer Flow	Large-scale structure, Time-averaged equations, Mixing length model, Wall friction and Heat transfer in boundary layer flow, and Other external flows.	TB:1 7.1 – 7.7; & 7.9
28-31	Turbulent Duct Flow	Velocity distribution, Friction factor and pressure drop, Heat transfer coefficient, Total heat transfer rate, and More refined turbulence models.	TB:1 8.1 – 8.5
32-36	Convection with Change of Phase	Condensation and Boiling	TB:1 10.1 – 10.2
37-40	Mass Transfer	Properties of mixtures, Mass concentration, Mass diffusivities, and Laminar forced convection.	TB:1 11.1 – 11.5

5. Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Midsem Test	90	25	7/3 9.00 - 10.30AM	Closed Book
Practicals with report submission (#10)	-	20	Continuous throughout the semester	Open Book
Literature Survey &Simulations based group seminars(#2)	-	20	Continuous throughout the semester	Open Book
Compre Exam	180	35	14/05 FN	Closed Book

6. Chamber Consultation Hour: To be announced in the class.

7. **Notices:**All notices concerning this course will be displayed in *CMS (institute's web-based Course Management System)*. Students are advised to visit *CMS*regularly for all notices and updates.

8. **Make-up Policy:**Make-up request for tests shall be granted only for the *genuine* case with sufficient evidence. Request letter duly signed by the student must reach the undersigned at least one day before the scheduled test.

9. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE(ME G534)