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**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.

1. **Text Book (TB):**
2. A. Bejan, *Convective Heat Transfer*, Wiley India Pvt. Ltd, Third Edition, 2004.
3. W. M. Kays, M. E. Crawford, and B. Weigand, *Convective Heat and Mass Transfer*, McGraw-Hill Int. Edition, Fourth Edition, 2005.
4. **Reference Book (RB):**
5. RB1: S. Kakac and Y. Yener, *Convective Heat Transfer*, CRC Press, Second Edition, 1995.
6. RB2: J. G. Collier, and J. R. Thome, *Convective Boiling and Condensation*, Oxford University Press, Third Edition, 1996.
7. **Course Plan:**

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| --- | --- | --- | --- |
| 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 |

1. **Evaluation Scheme:**

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| --- | --- | --- | --- | --- |
| 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 |

1. **Chamber Consultation Hour:**To be announced in the class.
2. **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.
3. **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.
4. **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)**