Second Level Course in Heat Transfer - Web course

COURSE OUTLINE

This course is essentially a fortification of the concepts learnt in a first course in heat transfer. The various topics learnt in conduction, convection and radiation are revisited and a little more information on these topics presented. The approach shall be analytical with little or no numerical solution component - a few problem solving sessions will be included. The detailed plan is given below.

COURSE DETAIL

Sl.No	Topics	Hours
1.	Introduction and derivation of conduction equation.	1
2.	One dimensional steady conduction with and without heat generation. Fin analysis and optimization of fin dimensions and insulation thickness.	3
3.	Two dimensional steady conduction. Source sink analogy for heat transfer problems.	2
4.	Unsteady conduction – lumped and one dimensional. Use of governing equations to infer orthogonality of functions. Solution for higher dimensions as special cases of one dimensional situation.	3
5.	Duhamels theorem and applications for time varying boundary conditions.	2

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Mechanical Engineering

Pre-requisites:

An introductory level course in Heat Transfer.

Additional Reading:

Several good books on Heat Transfer are available - any can serve as additional reading material.

Coordinators:

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6.	Derivation of governing equation for convection.	2
7.	2D laminar Couette flow and nondimensional numbers. Concept of Adiabatic wall temperature.	2
8.	Pipe flow – concept of developed temperature profile and solutions for constant wall flux and constant wall temperature boundary conditions. Solution of entry length problem for constant wall and constant wall flux boundary conditions.	4
9.	Boundary Layer theory – Falkner Skan similarity solution for momentum and thermal boundary layers.	3
10.	Integral methods for momentum and thermal boundary layers.	2
11.	Natural convection – governing equation, integral solution for flat surface.	2
12.	Convection in turbulent flows. Turbulent momentum and thermal boundary layers. Performance evaluation of turbulators used for heat transfer enhancement.	4
13.	Radiation Heat Transfer – Introduction. Shape factor calculations. Radiation calculation using radiosity approach.	2
14.	Gas Radiation. Network method for absorbing, transmitting and reflecting media. Use of zonal method for furnace calculations.	3
15.	Two phase flow: Basic equations of two	1

	phase flow.	
16.	Subcooled and fully developed boiling heat transfer. Heat transfer in critical heat flux.	4
17.	Condensation, Melting and solidification.	2

References:

1. Venkateshan, S.P. "Heat Transfer", Ane's Student Edition.
2. Incropera, F.P. and Dewitt, D.P. "Fundamentals of Heat and Mass Transfer", John Wiley Publishing Company.
3. Oosthuizen, P.H., Naylor, D. "Introduction to Convective Heat Transfer Analysis", Mc Graw Hill, 1999.
4. Holman, J. P. "Heat Transfer", 7th edition, Mc Graw Hill, 1992.
5. Ozisik, M. N. "Heat Transfer - A Basic Approach", Mc Graw Hill, 1985.
6. Collier, J. G., Thome, J.R. "Convective Boiling and Condensation", 3rd edition, Clarendon Press, Oxford, 1996.