

AE6004 HEAT TRANSFER

DETAILED SYLLABUS

OBJECTIVES:

- To impart knowledge on various modes of heat transfer and methods of solving problems. Also, to give exposure to numerical methods employed to solve heat transfer problems.

UNIT I CONDUCTION

Governing equation in cartesian, cylindrical and spherical coordinates. 1-D steady state heat conduction with and without heat generation. composite wall- electrical analogy – critical thickness of insulation – heat transfer from extended surface – effect of temperature on conductivity- 1-D transient analysis

UNIT II CONVECTION

Review of basic equations of fluid flow – dimensional analysis- forced convection – laminar flow over flat plate and flow through pipes-flow across tube banks. turbulent flow over flat plate and flow through pipes – free convection – heat transfer from vertical plate using integral method – empirical relations - types of heat exchangers – overall heat transfer coefficient – LMTD and NTU methods of analysis.

UNIT III RADIATION

Basic definitions – concept of black body - laws of black body radiation-radiation between black surfaces – radiation heat exchange between grey surfaces – radiation shielding – shape factor- electrical network analogy in thermal radiation systems.

UNIT IV NUMERICAL METHODS IN HEAT TRANSFER

1-D and 2-D steady and unsteady state heat conduction – composite walls-heat generation-variable thermal conductivity- extended surfaces analysis using finite difference method- Convective heat transfer- Stream function - vorticity method- creeping flow analysis- convection-diffusion 1-D, 2-D analysis using finite difference approximation. Numerical methods applicable to radiation heat transfer.

UNIT V PROBLEMS IN AEROSPACE ENGINEERING

Heat transfer problems in gas turbines, rocket thrust chambers- aerodynamic heating – ablative heat transfer

TEXT BOOKS:

1. Yunus, A. Cengel, "Heat Transfet-A Practical Approach", Tata McGraw Hill, Second edition, 2003.
2. Holman, J.P, "Heat Transfer", McGraw Hill Book Co., Inc., New York, Sixth Edition,1991.
3. Sachdeva, S.C. "Fundamentals of Engineering Heat and Mass Transfer", Wiley EasternLtd., New Delhi,1981.

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REFERENCES:

1. Lienhard, J.H., A Heat Transfer Text Book, Prentice Hall Inc., 1981.
2. Sutton, G.P., Rocket Propulsion Elements, John Wiley and Sons, Fifth Edition, 1986.
3. Mathur, M. and Sharma, R.P., Gas Turbine and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1988.