COURSE CODE	COURSE TITLE	L	T	P	C
1152AE120	HEAT TRANSFER	3	0	0	3

Course Category:

Programme Elective

a. Preamble :

This course provides an introduction to the basic concepts and techniques of heat transfer and application of mathematical principles in heat transfer. Understanding the fluid kinematics & boundary layer concepts with respect to heat transfer.

b. Prerequisites :

- Aero engineering Thermodynamics

c. Links to other courses:

- Computational Fluid Dynamics
- Finite Element Method

d. Course educational objectives :

Students undergoing this course are expected:

- To understand the modes of heat transfer and their applications.
- To educate the students with the heat exchangers and heat transfer problems in combustion and nozzle of aerospace propulsive systems.

e. Course outcomes :

On the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Apply heat conduction equations for real time problems.	K2
CO2	Solve convective heat transfer problems on open and closed conduits.	K3
CO3	Apply radiative heat transfer concepts to solve the various black body problems.	K3
CO4	Estimate the performance of heat exchangers by different methods.	K5
CO5	Apply the knowledge of heat transfer in aerospace.	K4

(K1 – Remember; **K2** – Understand; **K3** – Apply K4-Analyze, K5 – Evaluate, K6 - Create)

Correlation of co's with programme outcomes :

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	H	H	H		H		H		L	
CO2	L	H	H	H		H		H		L	
CO3	L	H	H	H		H		H	L	L	

CO4	L	H	H	H		H		H		L	
CO5	L	H	H	H		H		H		L	

f. COURSE CONTENTS :

UNIT I - HEAT CONDUCTION **L - 9**

Basic Modes of Heat Transfer – One dimensional steady state heat conduction: Composite Medium – Critical thickness – Effect of variation of thermal Conductivity – Extended Surfaces – Unsteady state. Heat Conduction: Lumped System Analysis – Heat Transfer in Semi-infinite and infinite solids – Use of Transient – Temperature charts – Application of numerical techniques.

UNIT II - CONVECTIVE HEAT TRANSFER **L - 9**

Introduction – Free convection in atmosphere free convection on a vertical flat plate – Empirical relation in free convection – Forced convection – Laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations, application of numerical techniques in problem solving.

UNIT III - RADIATIVE HEAT TRANSFER **L - 9**

Introduction to Physical mechanism – Radiation properties – Radiation shape factors – Heat exchange between non – black bodies – Radiation shields.

UNIT IV - HEAT EXCHANGERS **L - 9**

Classification – Temperature Distribution – Overall heat transfer coefficient, Heat Exchange Analysis – LMTD Method and E-NTU Method, problems using LMTD and E-NTU methods.

UNIT V- HEAT TRANSFER PROBLEM IN AEROSPACE ENGINEERING

High-Speed flow Heat Transfer, Heat Transfer problems in gas turbine combustion chambers – Rocket thrust chambers – Aerodynamic heating – Ablative heat transfer, Heat transfer problems in nozzles.

Total Periods=45

Text Books :

1. Yunus A. Cengel., "Heat Transfer – A practical approach", Second Edition, Tata McGraw-Hill, 2002.
2. Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi, 1981
3. Incropera. F.P.andDewitt.D.P. "Introduction to Heat Transfer", John Wiley and Sons – 2002.

References:

1. Lienhard, J.H., "A Heat Transfer Text Book", Prentice Hall Inc., 1981.
2. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6thEdn. 1991.
3. Mathur, M. and Sharma, R.P. "Gas Turbine and Jet and Rocket Propulsion", Standard Publishers, New Delhi 1988.