AMITY UNIVERSITY
UTTAR PRADESH

Course Title : HEAT TRANSFER **Credit Units: 03**

L	T	P/S	SW/ FW	TOTAL CREDIT UNITS
3	-	-	-	3

Course Code: AERO412

Course Level : UG

Course Objectives

This course aims to provide the students essential knowledge on various modes of heat transfer and its application in solving problems related to aero-thermodynamics of rockets and launch vehicles. Specifically this course would deal with aero-thermal design and analysis of various rocket systems.

Pre-requisites: Mechanics of Fluids & Thermodynamics

Course Contents/Syllabus:

	Weightage (%)
Module I : Introduction to Heat Transfer	**25**
Descriptors/Topics : One Dimensional steady state heat conduction; derivation of governing equations; Types of boundary conditions. Two –Dimensional steady state heat conduction for flat plate with different boundary conditions. One dimensional transient heat conduction; lumped heat capacity system; Heisler charts. Conduction-convection systems-extended for problem	
Module II : Radiation Heat Transfer	**20**
Descriptors/Topics : Introduction to radiation, electro-magnetic radiation, wavelength spectrum. Laws of radiation; Planck's law; Rayleigh's law; Wein's displacement law; Kirchhoff's law; Stefan Boltzmann law. Radiation exchange between two parallel plates. Radiation exchange between two bodies orbitrally located with respect to each other concept of radiation view factors. Gaseous radiation.	
Module III : Convection heat transfer	**30**
Descriptors/Topics : Free & forced convection; major differences. Hydrodynamic boundary layer analysis, skin friction buffer, thermal boundary layer analysis. Derivation of governing equations for heat transfer from heated plate; Imperial correlation for natural convection. Forced convection in external flows; compressible boundary layers; problem of aerodynamic heating.	

Module IV : Aero-thermal design of launch vehicles	**10**
Descriptors/Topics : Design consideration for aero-thermal design of launch vehicles during pre launch & ascent flight phase; Thermal design problems related to solid and liquid propeller rocket-motors' base heating.	
Module V : Heat exchangers	**10**
Descriptors/Topics : Types of heat exchangers' LMTD' Q-NTU method of heat exchanger analysis.	
Module VI : Boiling & condensation	**5**
Descriptors/Topics: Film condensation; drop-wise condensation. Analysis of boiling problem; different boiling regime.	

Student Learning Outcomes:

- Describe phenomenon of heat transfer in one & two dimensions for steady & unsteady state of heat conduction, convection and radiation.
- Describe the different laws which explain the radiation heat transfer.
- Analyze the boundary layer and governing equations of heat transfer.
- Analyze and design of thermal protection systems for rockets & re-entry space vehicles.
- Determine the performance of heat transfer devices.

Pedagogy for Course Delivery: Session Plan / course-material uploading, Class-room teaching associated with assignments, presentations**,** quiz, viva-voce and evaluation.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
100	**NA**	**100**

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment - 30					End Term Examination
Components (Drop down)	**A**	**CT**	**S/V/Q**	**HA**	**70**
Weightage (%)	5	10	8	7	70

Text & References:

- J. P. Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997

- A. Bejan, Heat Transfer, John Wiley, 1993

Any other Study Material: