INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

HEAT TRANSFER LABORATORY								
VI Semester: ME								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AMED44	**Core**	-	-	2	1	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Thermal and Fluids Engineering Laboratory								

I. COURSE OVERVIEW:
Heat transfer laboratory is intended to enhance the learning experience of the student about the flow of thermal energy due to temperature difference and the subsequent temperature distribution changes. This laboratory focuses on heat transfer modes, boundary conditions, one dimensional steady and unsteady state condition and heat exchangers applied to modern electric and electronic plants require efficient dissipation of thermal losses. Students are expected to gain experience in hands on training as well as knowledge to model heat exchangers, heat treatment of fins and complex mechanical systems.

II. COURSES OBJECTIVES:
The students will try to learn

I. The design calculations of different modes of heat transfer to improve the efficiency of heat transfer rate and thermal conductivity with different materials.
II. The validating heat transfer parameters during internal and external flows based on non-dimensional numbers with convective mode heat transfer.
III. The performance and analysis of heat exchangers for real-time applications using logarithmic mean temperature difference and number of transfer unit methods.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO 1 Demonstrate the steps involved with different surfaces and geometries for which the temperature distribution and heat flow rates are calculated for automotive industry components like radiators, engine blocks.
CO 2 Execute the principles associated with convective heat transfer to formulate and calculate the dynamics of temperature field in fluid flow for real time applications.
CO 3 Determine the surface heat transfer coefficient in natural convection of heated vertical cylinder for forced convection in a drop wise and film wise condensation.
CO 4 Make use of the phenomena of boiling and condensation to give various correlations applied to heat exchangers, boilers and heat engines.
CO 5 Select the appropriate expression in overall heat transfer coefficient for modelling heat exchanger to achieve defect / error free components.
CO 6 Apply the lumped heat capacity method in unsteady heat transfer process to study the rates of heat transfer for different materials and geometries.

IV. COURSE CONTENT:

WEEK -1: CALCULATING THE OVERALL HEAT TRANSFER COEFFICIENT FOR A COMPOSITE SLAB
Determine the overall thermal conductance for a composite wall and compare with theoretical value.

WEEK -2: DETERMINE THE THERMAL CONDUCTIVITY OF COAXIAL CYLINDRICAL SURFACE
Determine combined convective and radiation heat transfer coefficient at each zone and compare them to decide the critical thickness of insulation.

WEEK -3: DETERMINATION OF THERMAL CONDUCTIVITY 0F INSULATING POWDER
Determine the thermal conductivity of given concentric sphere.

WEEK -4: DETERMINE THE THERMAL CONDUCTIVITY OF THE METAL ROD
To measure the temperature gradient along the length of the metal (copper) rod.

WEEK -5: CALCULATE THE EFFECTIVENESS AND EFFICIENCY OF PIN FIN
To determine the rate of heat transfer of circular pin-fin.

WEEK -6: DETERMINE THE THERMAL CONDUCTIVITY SPECIMEN IN TRANSIENT MODE
Obtain the specimen temperature at any interval of time transient heat conduction apparatus.

WEEK -7: CALCULATE CONVECTIVE HEAT TRANSFER COEFFICIENT IN FORCED CONVECTION
Determine the rate of heat transfer through pin-fin forced convection.

WEEK -8: CALCULATING CONVECTIVE HEAT TRANSFER COEFFICIENT
Determine the rate of heat transfer with natural convection.

WEEK -9: CALCULATE THE EFFECTIVENESS OF HEAT EXCHANGERS BOTH EXPERIMENTAL AND THEORETICAL METHOD
Determine LMTD, effectiveness and overall heat transfer coefficient for counter flow heat exchanger.

WEEK -10: DETERMINATION OF EMISSIVITY OF GREY AND BLACK BODY
Determine the emissivity measurement of radiating surfaces with grey body.

WEEK -11: DETERMINATION OF STEFAN BOTLZMAN CONSTANT AND COMPARE ITS VALUE
Determine the value of Stefan Boltzmann constant for radiation heat transfer.

WEEK -12: EVALUATE THE CRITICAL HEAT FLUX VALUE BY STUDYING DIFFERENT ZONES OF BOILING
Draw the graph of heat flux with bulk temperature up-to burnout (critical) condition.

WEEK -13: DEMONSTRATION OF HEAT PIPE TO DETERMINE THE AXIAL HEAT FLUX USING WATER AS THE WORKING FLUID WITH THAT OF A SOLID COPPER WITH DIFFERENT TEMPERATURES
Determine the axial heat flux in a heat pipe using water as the working fluid with that of a solid copper with different temperatures.

WEEK -14: DETERMINE OVERALL HEAT TRANSFER COEFFICIENT AND UNDERSTANDING DIFFERENT METHODS OF CONDENSATION
Determine overall heat transfer coefficient Film and Drop Wise Condensation Apparatus.

V. TEXT BOOKS:

1. Yunus A. Cengel, "*Heat Transfer a Practical Approach,"* Tata McGraw hill Education (P) Ltd, New Delhi, India. 4th Edition, 2012.
2. R. C. Sachdeva, "*Fundamentals of Engineering, Heat and Mass Transfer,"* New Age, New Delhi, India, 3rd Edition, 2012.

VI. REFERENCE BOOKS:

1. Holman, "Heat Transfer", Tata McGraw-Hill education, 10th Edition, 2011.
2. P. S. Ghoshdastidar, "Heat Transfer", Oxford University Press, 2nd Edition, 2012.

VII. ELECTRONICS RESOURCES:

1. https://elearn.nptel.ac.in/shop/iit-workshops/ongoing/heat transfer-for-practicing-engineers/.
2. https://akanksha.iare.ac.in/index?route=course/details&course_id=94.

VIII. MATERIALS ONLINE:

1. Course Content
2. Lab manual