DEPARTMENT OF MECHANICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	Advanced Heat Transfer		
Course Code	ME 605	**No. of Credits**	3
Course Code of Pre-requisite subject(s)			
Session	**July 2021**	**Section (if, applicable)**	
Name of Faculty	Dr. K S S Harish	**Department**	Mechanical Engineering
Email	harish@nitt.edu	**Telephone No.**	9940404264
Course Type	✓ **Core course**	☐ **Elective course**	

Syllabus (approved in BoS)

Transient heat conduction – Exact solution – Use of Heisler and Grober charts–Semi-infinite solids – Multidimensional systems.

Extended surfaces – Steady state analysis and optimization – Longitudinal fin of rectangular, triangular and parabolic profile radiating to free space – Radial fins.

Thermal boundary layers – Momentum and energy equations – Internal and external flows – Forced convection over cylinders, spheres and bank of tubes, turbulent convection.

Heat transfer with phase change – Condensation and boiling heat transfer – Heat transfer in condensation, Effect of non-condensable gases in condensing equipment – Pool and flow boiling correlations.

Thermal radiation – View factor – Gas radiation – Transmitting, reflecting and absorbing media – Flame radiation in furnaces – Radiation effect on temperature measurement.

COURSE OBJECTIVES

1. To learn the various modes of heat transfer and understand the basic concepts of mass transfer.
2. To understand the applications of various experimental heat transfer correlations in engineering applications.
3. To discuss the thermal analysis and sizing of heat exchangers.

COURSE OUTCOMES (CO)

Course Outcomes ***Upon the completion of the course, the students will be able***	**Aligned Programme Outcomes (PO)**
1. Explain the real time applications of heat transfer in both solids and fluids.	1,2,3,7,10
2. Describe the fundamentals of natural and forced convective heat transfer processes	1,2,3,5
3. Design the heat exchange equipment.	1,2,4,7,10
4. Explore the real time applications of radiation mode of heat transfer.	1,2,7,10
5. Relate the heat transfer concepts for various industrial applications.	1,2,3,4,7,10

COURSE PLAN – PART II

COURSE OVERVIEW

It is planned to teach the course interactively, rather than by a strict lecture format. The class will cover the fundamentals such as conduction, convection, thermal radiation as well as thermally driven problems of current importance. This course is designed to introduce a basic study of the phenomena of heat and mass transfer. The methodologies for solving a wide variety of practical engineering problems and useful information concerning the design and performance of heat transfer equipment will be discussed.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	**Week**	**Topic**	**Mode of Delivery**
1	1st week	Transient heat conduction, Exact solution Use of Heisler and Grober chart.	Online Mode MS TEAMS
2	2nd week	Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, unsteady state Conduction.	Online Mode MS TEAMS
3	3rd week	Problems related to basic heat transfer, extended surfaces	Online Mode MS TEAMS
4	4th week	Radiative transfer – electromagnetic radiation spectrum – thermal radiation – radiation properties - Black body, gray body.	Online Mode MS TEAMS

5	5th week	Shape factor and Radiation shields	Online Mode MS TEAMS
6	6th week	Radiative exchange in furnaces	Online Mode MS TEAMS
7	7th week	Convective heat transfer – Newton's law of cooling – Prandtl number – Laminar forced convection heat transfer from flat plates – fully developed laminar flow in pipes	Online Mode MS TEAMS
8	8th week	Turbulent forced convection – Reynolds' analogy , Free/Natural convection	Online Mode MS TEAMS
9	9th week	Natural convection heat transfer from vertical plates and horizontal tubes	Online Mode MS TEAMS
10	10th week	Free convection correlations Problems related to free convection	Online Mode MS TEAMS
11	11th week	Condensation and Boiling – film and dropwise condensation – pool boiling and flow boiling – Introduction to multiphase flow and heat transfer.	Online Mode MS TEAMS
12	12th week	Effect of non-condensable gases in condensing equipment. Flow boiling correlations.	Online Mode MS TEAMS
13	13th week	Convective heat transfer – Newton's law of cooling – Prandtl number – Laminar forced convection heat transfer from flat plates – fully developed laminar flow in pipes	Online Mode MS TEAMS

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Test 1	Oct 2021	0.75 hour	10
2.	Mid Exam	Nov 2021	1.5 hour	30
3.	Test 2	Nov 2021	0.75 hour	10
CPA	Compensation Assessment*	Before final assesment	1 hour	20

4.	Assignments	Oct & Nov 2021		20
5.	Final Assessment *	At the end of semester	3 hours	30

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Student can interact the faculty at any stage in the course duration in case he/she finds difficulty in understanding the concept.
2. Feedback form is issued to student to express their comments after completing the syllabus. Student are requested to give genuine feedback about the course.
3. Student knowledge about this course will be judged based on marks obtained in the written examination.

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc)

All the correspondence will be done through their class representative (**CR**).

ATTENDANCE

1. At least 75% attendance is mandatory for all course
2. A maximum of 10% shall be allowed under on duty (OD) category.
3. Student less than 65% attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

COMPENSATION ASSESSMENT

1. Attending all the assessments are MANDATORY for every student.
2. One compensation assessment (CPA) will be conducted for those student who are being physically absent for any of the assessment and it covers the entire content of the course.
3. At any case, CPA will not be considered as an improvement test.

ACADEMIC DISHONESTY & PLAGIARISM

1. Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.

2. Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.

3. The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty.The report shall be submitted to the Academic office.

4. The above policy against academic dishonesty shall be applicable for all the programs.

ADDITIONAL INFORMATION, IF ANY

The faculty is available for consultation at times as per the intimation given by the faculty. Queries (if required) to the course teacher shall only be emailed to the email id specified by the teacher(harish@nitt.edu)

FOR APPROVAL

30/09/2021

30/09/2021

Course Faculty **CC- Chairperson** **HOD**