M.E Semester: 1 Mechanical Engineering (Thermal Engineering)
Subject Name: Advanced Thermodynamics and Heat Transfer

A. **Course Objective:**

- To present a problem oriented in depth knowledge of Advanced Thermodynamics and heat transfer
- To address the underlying concepts and methods behind Advanced Thermodynamics and heat transfer

B. **Teaching / Examination Scheme**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
METH102	Advanced Thermodynamics & Heat Transfer	4	0	2	6	5	3	70	30	20	30	150

C. **Detailed Syllabus**

1. Concept of Exergy and Entropy; Exergy for closed system; Entropy generation; entropy balance for closed system; behavior of gases; Equations of state.

2. Phase equilibrium; phase rule without chemical reaction; chemical potential of ideal gases; T-ds equations for simple compressible systems; Helmholtz and Gibbs functions; Maxwell relations; generalized relations for changes in enthalpy; entropy and internal energy; equations for specific heats; Clausius clapeyron equation; Joule-Thomson and Joule coefficients; applications of thermodynamic relations

3. Review of the basic laws of conduction; One dimensional steady state conduction with variable thermal conductivity and with internal distributed heat source; Extended surfaces-review and design considerations; Two dimensional steady state conduction; Unsteady state conduction; solutions using Groeber's and Heisler's charts for plates, cylinders and spheres suddenly immersed in fluids.

4. Review of convection heat transfer laws, Natural and forced convection; Heat transfer in turbulent flow; eddy heat diffusivity; Reynold's analogy between skin friction and heat transfer; von Karman; turbulent flow through circular tubes
5. Review of radiation heat transfer laws and principles; diffuse surfaces and the Lambert's Cosine law; Radiation through non-absorbing media; Hottel's method of successive reflections.

D. **Lesson Planning**

Sr.No.	Date/Week	Unit No.	% Weightage	Topic No:
1	1^{st} ,2^{ed} ,3^{ed}	Unit 1	20 % .	1
2	4^{th} ,5^{th} ,6^{th}	Unit 2	20 %	2
3	7^{th} ,8^{th} ,9^{th}	Unit 3	20 %	3
4	19^{th} ,11^{th} ,12^{th}	Unit 4	20 %	4
5	13^{th} ,14^{th} ,15^{th}	Unit 5	20 %	5

E. **Instructional Method & Pedagogy**

1. At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2. Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
3. Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.

4. One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5. Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6. Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
7. The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.

8. Experiments shall be performed in the laboratory related to course contents.

1 Conduction heat transfer in composite wall.
2 Conduction heat transfer in metal rod.
3 Conduction heat transfer in through insulating powder.
4 Conduction heat transfer from a Pin fin.
5 Convection heat transfer in forced convection.
6 To study unsteady state heat transfer by the lumped capacitance
7 To study of heat transfer in the process of condensation.
8 To determine the value of Stefan Boltzmann constant for radiation heat transfer.
9 To measure the emissivity of test plate.
10 To study the pool boiling phenomena and measure the critical heat flux.

F. **Students Learning Outcomes**

- The student can identify different areas of Thermodynamics and Heat Transfer.
- Can find the applications of all the areas in day to day life.

G. **Recommended Study Materials**

- **Text & Reference Books:**

1. Fundamentals of Engineering Thermodynamics, Moran MJ & Shapiro HM, John Wiley,
2. Engineering Thermodynamics work and heat Transfer, Roger Gordon & Yon Mayhew, Addison-Wesley, 2001
3. Thermodynamics an Engineering Approach, Cengel Y.A. & Boles M.A., TMH.
4. Fundamentals of Classical Thermodynamics, Van Wylen GJ & S onntag RE, Wiley 2
5. Thermodynamics, Wark K. Jr. & Donald E.R.,McGraw Hill (6th Edn.); 1999.
6. Fundamentals of Heat Transfer, Encropera
7. Heat, Mass and Momentum transfer, Rohsenow and Choi Prentice Hall
8. Fundamentals of Heat Transfer, Grober, Erk and McGraw Hill Grigull
9. Analysis of Heat and Mass Transfer, Eckert and Drake McGraw Hill
10. Thermal Radiation, Siegel and Howell McGraw Hill.
11. Engineering Thermodynamics by Jones & Dugan
12. Engineering Thermodynamics by P. K. Nag
13. Basic Engineering Thermodynamics by T Ray chaudhary
14. Fundamentals of Engineering thermodynamics, R. Yadav.
15. Advanced thermodynamics Engineering, KalyanAnnamalai&Ishwar K Puri, CRC Press.
16. Heat and Mass Transfer, R.K.Rajput
17. Heat and Mass Transfer, D.S.Kumar
18. Handbook of Thermal Engineering, Kreith F