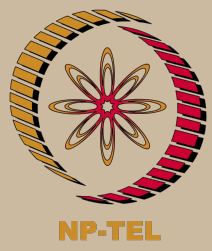
# Advanced Engineering Thermodynamics - Web course




NPTEL

**http://nptel.iitm.ac.in**

Mechanical Engineering

## COURSE OUTLINE

The present course on **Advanced Engineering Thermodynamics** deals with in-depth theories of thermodynamics. Apart from classical theory, this course presents detail on kinetic theory as well as statistical theories.

Emphasis is given in understanding the thermodynamics based on classical theory in Modules I to III. Laws of thermodynamics, entropy and exergy are discussed with examples.

Equilibrium and stability, Maxwell equations are discussed in details. Phase transition and reaction thermodynamics are given in details which will be helpful for engineering students at graduate level.

The other two modulii of the book covers the kinetic theory of gases and statistical thermodynamics. Some background of quantum mechanics at 10+2 level will help the student in understanding the last module (i.e, statistical thermodynamics).

The course will be very useful to post-graduate students, teachers and practitioners. A number of chosen problems will be solved to illustrate the concepts clearly.

**Contents:** Review of first and second law of thermodynamics, Maxwell equations, Joule-Thompson experiment, irreversibility and availability, exergy analysis, phase transition, types of equilibrium and stability, multi-component and multi-phase systems, equations of state, chemical thermodynamics, combustion.

Third law of thermodynamics, Kinetic theory of gases- introduction, basic assumption, molecular flux, equation of state for an ideal gas, collisions with a moving wall, principle of equipartition of energy, classical theory of specific heat capacity.

Transport phenomena-intermolecular forces, The van der Waals equation of state, collision cross section, mean free path, Statistical thermodynamics-introduction, energy states and energy levels, macro and microscales, thermodynamic probability, B-E, F-D, M-D statistics, distribution function, partition energy, statistical interpretation of entropy, application of statistics to gases-mono-atomic ideal gas.

## COURSE DETAIL

| Module | Topics and Contents | Hours |
|---|---|---|
| Module I | Review of first and second law of thermodynamics, Maxwell equations, Joule-Thompson experiment, irreversibility and availability, exergy analysis. | 12 |
| Module II | Phase transition, types of equilibrium and stability, multi-component and multi-phase systems, equations of state. | 8 |
| Module III | Chemical thermodynamics, combustion. Third law of thermodynamics. | 8 |

**Pre-requisites:**

Basic Thermodynamics.

**Coordinators:**

**Prof. P. Mahanta**
Department of Mechanical EngineeringIIT Guwahati

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| Module IV | Kinetic theory of gases- introduction, basic assumption, molecular flux, equation of state for an ideal gas, collisions with a moving wall, principle of equipartition of energy, classical theory of specific heat capacity.<br><br>Transport phenomena-intermolecular forces, The Van der Waals equation of state, collision cross section, mean free path. | 8 |
| Module V | Statistical thermodynamics- introduction, energy states and energy levels, macro and microscales, thermodynamic probability, B-E, F-D, M-D statistics, distribution function, partition energy, statistical interpretation of entropy, application of statistics to gases-mono-atomic ideal gas. | 8 |

**References:**


1. A. Bejan, Advanced Engineering Thermodynamics, 3rd edition, John Wiley and sons, 2006.
2. F.W.Sears and G. L. Salinger, Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Narosa Publishing House, New Delhi, 3rd edition, 1998.
3. M.J.Moran and H.N.Shapiro, Fundamentals Of Engineering Thermodynamics, John Wiley and Sons.
4. M. W. Zemansky and R. H. Dittman, Heat and Thermodynamics, Mc Graw Hill International Editions, 7th edition, 2007.
5. I. K. Puri and K. Annamalai, Advanced Engineering Thermodynamics, CRC Press, 2001.