| Course Code TEE 801 | Credit Hours (Th-Pr) 3.0-0 | **Advanced Thermodynamics (Core)** | Contact Hrs/Week (Th-Pr) 3.0-0 | Total Contact Hrs (Th-Pr) 45-0 |
|---|---|---|---|---|

**Course Outline:**

1. Review of first and second law of thermodynamics, Maxwell equations, Joule-Thompson experiment, irreversibility and availability, energy 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. Pinch technology.

**Eligibility Criteria:**

2. B.E in Mech., Elect (Power), Chemical, Industrial, Process
B.S (4-years) Or M.Sc. degrees in Physics

3. **Recommended Books**:

| S. No. | Title | Author(s) | Assigned Code | Remarks |
|---|---|---|---|---|
| a. | Advanced Engineering Thermodynamics | Bejan A | BA | Text |
| b. | Advanced Thermodynamics for Engineers | D. Winterbone; Ali Turan | AD | Text |
| c. | Thermodynamics Advanced Applications | Roger Kinsky | RK | Reference |
| d. | Thermodynamics: An Engineering Approach | Yunus A. Cengel | YC | Reference |
| e. | Advanced Thermodynamics Engineering | Kalyan Annamalai | KA | Reference |

**Course Objectives:**

4. Primary objective is for student to develop a sound understanding in the theory and application of thermodynamics at the advanced levels.

**Learning outcome:**

5. A student who has met the objectives of the course will be able to: explain basic thermodynamic concepts and laws describe the concepts entropy and exergy and their use in analyses of thermal energy systems analyze power plants and thermal/chemical installations, evaluate means for minimizing exergy losses in selected processes and Use advanced thermodynamics on a research case.

**Topics Covered:**

| No. | Topics | Text Book | Contact Hours |
|---|---|---|---|
| 1. | Review of first and second law of thermodynamics, Maxwell equations, Joule-Thompson experiment, irreversibility and availability, exergy analysis. Gas cycles, Carnot, Otto, Diesel, Dual, Stirling, PV andTS Diagrams, power, efficiency, work | BA, AD & YC | 08 |
| 2. | Engines, I.C. engines, operation principles, cycles, 2 and 4 strokes, pressure. charging, engine trials, indicated and brake power Steam and gas turbines, principles, schematic plant, layouts, application of appropriate cycles, constructional features, work done, blade efficiency, axial thrust, efficiencies, heat exchanger effectiveness. Nozzles steam and air flow, critical pressure ratio, nozzle shapes, super-saturation | | 06 |
| 3. | Phase transition, types of equilibrium and stability, multi-component and multi-phase systems, equations of state. | BA, AD & YC | 06 |
| 4. | Chemical thermodynamics, combustion. Third law of thermodynamics. Fuels and combustion calculations, chemical equations of combustion, air/fuel ratios, analysis of exhaust gases, gas analysis equipment, solid, liquid and gaseous fuels, calorific values of fuels, preparation of fuels for use, fuel storage, application and use in modern plant. | BA, AD & YC | 07 |
| 5. | 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 | BA, AD & YC | 07 |
| 6 | Statistical thermodynamics- introduction, energy states and energy levels, macro and micro scales, 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 | BA, AD & YC | 06 |
| 7 | Steam and gas turbines, principles, schematic plant layouts, application of appropriate cycles, constructional features, work done, blade efficiency, axial thrust, efficiencies, heat exchanger effectiveness. Energy conservation and environmental effects, the environment, total energy conservation in plant, waste heat recovery, overall efficiencies, co-generation plants | BA, AD & YC | 05 |