A. **TITLE:** Thermodynamics

B. **COURSE NUMBER:** MECH 342

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 weeks

F. **SEMESTER(S) OFFERED:** Fall

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
   3 lecture hours per week

H. **CATALOG DESCRIPTION:**

This course will investigate thermal power and its applications using the first and second laws of thermodynamics. The properties of liquids and gases will be considered in their current and emerging applications to energy production. The fuel sources will be discussed for their energy input and output heat values. The efficiency of all energy applications will be explored while evaluating the theory of heat transfer. Applications of the Rankin, Otto, Brayton, and refrigeration cycles will be used in evaluating the energy production of thermal systems.

I. **PRE-REQUISITES/CO-REQUISITES:**
   a. Pre-requisite(s): PHYS 122: College Physics II and MATH 161: Calculus I
   b. Co-requisite(s): None

J. **GOALS (STUDENT LEARNING OUTCOMES):**

By the end of this course, the student will be able to:

<table>
<thead>
<tr>
<th>Course Objective</th>
<th>Institutional SLO</th>
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<tbody>
<tr>
<td>1. State the definition of work, energy, and heat.</td>
<td>1. Communication</td>
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<td>2. Differentiate between closed systems and open systems.</td>
<td>2. Critical Thinking</td>
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<td>3. Determine the flow work, and apply it to a system.</td>
<td>2. Critical Thinking</td>
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<td>4. State the first law of thermodynamics, or energy conservation, for both non-flow and flow systems.</td>
<td>1. Communication</td>
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<td>5. Define enthalpy and show that its properties are independent of the system.</td>
<td>1. Communication</td>
</tr>
<tr>
<td>6. Apply the first law to the analysis of a steam or gas turbine, pipe flow, boilers, nozzles, heat exchangers.</td>
<td>2. Critical Thinking</td>
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<td>7. Define the second law of thermodynamics.</td>
<td>1. Communication</td>
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<td>8. Differentiate a change in entropy for a process.</td>
<td>2. Critical Thinking</td>
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<td>9. Define the term “quality” and use it to determine energy in the fluid-vapor region of a power cycle.</td>
<td>1. Communication</td>
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<tr>
<td>10. Graphically interpret the energy state for</td>
<td>2. Critical Thinking</td>
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different processes on the Mollier chart.

| 11. Use a thermodynamic table to determine the properties of all fluids used in thermal application. | 3. Professional Competence |
| 12. Apply the ideal gas equations between the components and the entire mixture. | 2. Critical Thinking |

K. **TEXTS:**

L. **REFERENCES:**

M. **EQUIPMENT:** None

N. **GRADING METHOD:** A-F

O. **MEASUREMENT CRITERIA/METHODS:**
- Exams
- Quizzes
- Homework
- Participation

P. **DETAILED COURSE OUTLINE:**

I. Work, Energy, Heat
   A. Work
   B. Types of energy
   C. Heat
   D. Flow work vs. non flow work

II. First Law of Thermodynamics
   A. Non-flow systems
   B. Steady-flow systems
   C. Applications of the 1st law of thermodynamics

III. Properties of liquids and gases
   A. Liquids and vapors
   B. Properties of fluids
   C. Thermodynamic Diagrams

IV. Ideal Gas and Mixtures of Ideal Gases
   A. Entropy changes of an Ideal gas
   B. Non-flow gas processes
   C. Gas flow processes
   D. Mixture composition
   E. Air-Water Vapor mixture
   F. Psychrometric Chart
   G. Air Conditioning

V. Second Law of Thermodynamics
   A. Reversibility
B. The Carnot cycle
C. Entropy

VI. Entropy
   A. Directionality of the processes
   B. Isentropic processes
   C. Isentropic efficiencies

VII. Power Cycles
   A. Carnot Cycle
   B. Rankine Cycle
   C. Rating of power plants
   D. Otto Cycle
   E. Diesel Cycle
   F. Brayton cycle
   G. Stirling and Ericsson Cycle
   H. Refrigeration and heat pump

Q. LABORATORY OUTLINE: None