**Applied Thermodynamics**

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| Course code: IE 3201   | Semester: 7th  |
| Instructor: Asma Mushtaq  | Credit hours: 3 |

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| Course Description | Applied thermodynamics is an engineering science that is central to most mechanical engineering applications. This course introduces the thermodynamic basic concepts and laws that will be required in following courses and in professional applications. The course provides a background for understanding how energy systems such as engines and refrigerators operate. |

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| Course Learning Outcomes (CLOs) | CLO Statement Level\* PLO

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| CLO1 | ***Explain*** the importance of thermodynamics in various engineering fields. | C2 | 1 |
| CLO2 | ***Discuss*** the laws of thermodynamics for open and closed systems. | C3 | 1 |
| CLO3 | ***Compute*** the energy balance of a thermodynamic system comprehensively including the power cycles. | C3 | 2 |

 *\*Bloom’s Taxonomy level. C:Cognitive, A:Affective, P:Psychomotor* |

Mapping of CLOs according to the PLOs

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| Sr. No. | PLOs | CLO1 | CLO2 | CLO3 |
| 1 | Engineering Knowledge |  |  |  |
| 2 | Problem Analysis |  |  |  |
| 3 | Design / Development of Solutions |  |  |  |
| 4 | Investigation |  |  |  |
| 5 | Modern Tool Usage |  |  |  |
| 6 | The Engineer and Society |  |  |  |
| 7 | Environment and Sustainability |  |  |  |
| 8 | Ethics |  |  |  |
| 9 | Individual and Team-Work |  |  |  |
| 10 | Communication |  |  |  |
| 11 | Project Management |  |  |  |
| 12 | Lifelong Learning |  |  |  |

Relationship between assessment tools and CLOs:

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| Assessment tools | CLO1 | CLO2 | CLO3 |
| Assignments |  |  |  |
| Quizzes |  |  |  |
| Mid-semester Test |  |  |  |
| Final Exam |  |  |  |

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| Weekly Plan | Week | Topics |
| 1 | Heat, work and the system, Units. |
| 2 | The state of the working fluid, Reversibility, Reversible work. |
| 3 | Conservation of energy and the first law of Thermodynamics. |
| 4 | The non-flow equation and the steady flow equation. |
| 5 | Liquid, vapour and gas. The use of vapour tables and the perfect gas. |
| 6 | Reversible non-flow processes. |
| 7 | Reversible adiabatic non-flow processes. |
| 8 | Polytropic processes, Reversible flow processes. |
| 9 | Irreversible processes and non steady flow processes. |
| 10 | The heat engine, entropy, and T-S diagram. |
| 11 | Reversibility processes on T-S diagram, Entropy and irreversibility and exergy. |
| 12 | The Carnot cycle and its implementation, the Carnot cycle for a perfect gas. |
| 13 | The constant pressure cycle, the air standard cycle. |
| 14 | The Otto cycle and Diesel cycle. |
| 15 | The dual combustion cycle and mean effective pressure. |
| 16 | The Stirling and Ericsson cycles |

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| Text Book | Applied Thermodynamics for Engineering Technologists by T.D Eastop and A. MacConkey, Fifth Edition. |

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| Assessment  | Assessment tools | Marks |
| Assignments | 20 |
| Quizzes | 10 |
| Mid Term | 20 |
| Final Term | 50 |