**University of Management and Technology**

**School of Engineering**

**Department of Electrical Engineering**

**Course Outline**

Course code……ME 322………………… Course title……Applied Thermodynamics……………………

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| --- | --- |
| Program | BSEE |
| Credit Hours | 3 |
| Duration | One semester |
| Prerequisites | Nil |
| Resource Person(s) | Waseem Iqbal (Sec A, B & C ) |
| Counseling Timing | See on SEN-EE website |
| Contact | Waseem.iqbal@umt.edu.pk |

**Chairman/Director signature………………………………….**

**Dean’s signature…………………………… Date………………………………………….**

**Learning Objectives (measureable):**

Upon Completion of the course, the students will be able to:-

1. understand the working principles of various pressure measuring meters, components of a thermodynamic system and state postulate (quiz)
2. State the First Law and to define heat, work, thermal efficiency and the difference between various forms of energy. (quiz)
3. Identify and describe energy exchange processes (in terms of various forms of energy, heat and work) and use of property tables. (quiz & homework)
4. Explain how various heat engines work (e.g. a refrigerator, an IC engine, a jet engine). (quiz)
5. Apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (closed system devices, heaters, coolers, pumps, turbines, pistons, etc.) to estimate required balances of heat, work and energy flow. (quiz & homework)
6. Explain the concepts of path dependence/independence, reversibility/irreversibility and entropy change of various thermodynamic processes. (quiz & homework)
7. Apply ideal cycle analysis to simple heat engine cycles to estimate thermal efficiency and work as a function of pressures and temperatures at various points in the cycle. (quiz & homework)

**Learning Methodology:**

Lecture, interactive, participative

**Grade Evaluation Criteria**

Following is the criteria for the distribution of marks to evaluate final grade in a semester.

**Marks Evaluation Marks in percentage**

Sessional Assessments 25

Mid Term 25

Final exam 50

Total 100

**Recommended Text Book:**

**Text book: "**Thermodynamics - An Engineering Approach”, by Yunus A. Cengel and Michael A. Boles, 7th Edition, Tata McGraw Hill, 2010.

**Reference Books:**

1. Applied thermodynamics for engineers and Technologists, T. D. Eastop and Mckonkey, Longman, 5th Edition.
2. Applied thermodynamics, by Onkar Singh, 3rd Edition, New Age International Publishers.
3. Fundamentals of Engineering Thermodynamics, by Moran & Shapiro, 6th edition

**Calendar of Course contents to be covered during semester**

**Course code…….ME 322 Course title…Applied Thermodynamics……………**

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| --- | --- | --- |
| **Week** | **Course Contents** | **Reference Chapter(s)** |
| 1 | 1-1 Thermodynamics and energy  1-2 Importance of dimensions and units  1-3 Systems and control volumes  1-4 Properties of a system  1-5 Density and specific gravity  1-6 State and equilibrium  1-7 Processes and cycles  1-8 Temperature and Zeroth law of thermodynamics  1-9 Pressure | Ch-1 |
| 2 | 1-10 The Manometer  1-11 The Barometer & Atmospheric Pressure  2-1 Introduction  2-2 Forms of Energy  2-3 Energy transfer by Heat  2-4 Energy transfer by Work | Ch-1 & Ch-2 |
| 3 | 2-5 Mechanical forms of Work  2-6 First Law of Thermodynamics  3-1, 3-2  3-3 Phase change process of pure substances | Ch-2 & Ch-3 |
| 4 | 3-4 Property diagrams for phase change process (T-v and P-v)  3-5 Property Tables (use)  3-6 Ideal gas equation of state | Ch-3 |
| 5 | 4-1 Moving boundary work  4-2 Energy balance for closed system  4-3 Specific heats | Ch-4 |
| 6 | 4-4 Internal energy, enthalpy and specific heats of ideal gases  4-5 Internal energy, enthalpy and specific heats of solids and quality  5-1 Conversion of mass | Ch-4 & Ch-5 |
| 7 | 5-2 Flow work & energy of flowing fluid  5-3 Energy analysis of steady flow devices  5-4 Some steady flow engineering devices | Ch-5 |
| 8 | **Mid Term Examination** |  |
| 9 | 6-1 Introduction to second law  6-2 Thermal energy reservoirs  6-3 Heat engines  6-4 Refrigerators and Heat pumps | Ch-6 |

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| 10 | 6-5 Perpetual motion machines  6-6 Reversible and Irreversible processes  6-7 The carnot cycle  6-8 The carnot principles  6-9 & 6-10 The thermodynamic temperature scale and carnot heat engine  6-11 The carnot refrigerator and heat pump | Ch-6 |
| 11 | 7-1 Entropy  7-2 Increase of entropy principle  7-3 Entropy change of pure substances  7-4 Isentropic processes  7-5 Property diagrams involving entropy | Ch-7 |
| 12 | 7-6 What is entropy?  7-7 T-ds relations  7-8 Entropy change of liquids and solids  7-9 The entropy change of ideal gases | Ch-7 |
| 13 | 9-1 Basic considerations  9-2 Value of carnot cycle  9-3 Air standard assumptions  9-4 An overview of reciprocating engines  9-5 Otto Cycle (spark ignition engines) | Ch-9 |
| 14 | 9-6 Diesel Cycle (compression ignition engines)  9-7 Stirling and ericsson cycle  9-8 Brayton cycle (gas turbine engines) | Ch-9 |
| 15 | 9-11 Ideal jet propulsion cycle  10-2 Rankine cycle (vapor power cycle) | Ch-9 & Ch-10 |
| 16 | **Final Examination** |  |