**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 energy1-2 Importance of dimensions and units 1-3 Systems and control volumes 1-4 Properties of a system 1-5 Density and specific gravity1-6 State and equilibrium1-7 Processes and cycles1-8 Temperature and Zeroth law of thermodynamics1-9 Pressure | Ch-1 |
|  2 | 1-10 The Manometer1-11 The Barometer & Atmospheric Pressure2-1 Introduction2-2 Forms of Energy2-3 Energy transfer by Heat2-4 Energy transfer by Work | Ch-1 & Ch-2 |
|  3 | 2-5 Mechanical forms of Work2-6 First Law of Thermodynamics3-1, 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 work4-2 Energy balance for closed system 4-3 Specific heats | Ch-4 |
|  6 | 4-4 Internal energy, enthalpy and specific heats of ideal gases4-5 Internal energy, enthalpy and specific heats of solids and quality5-1 Conversion of mass | Ch-4 & Ch-5 |
|  7 | 5-2 Flow work & energy of flowing fluid5-3 Energy analysis of steady flow devices5-4 Some steady flow engineering devices | Ch-5  |
|  8 | **Mid Term Examination** |  |
|  9 | 6-1 Introduction to second law6-2 Thermal energy reservoirs6-3 Heat engines6-4 Refrigerators and Heat pumps  | Ch-6 |

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|  10 | 6-5 Perpetual motion machines6-6 Reversible and Irreversible processes6-7 The carnot cycle 6-8 The carnot principles6-9 & 6-10 The thermodynamic temperature scale and carnot heat engine6-11 The carnot refrigerator and heat pump | Ch-6 |
|  11 | 7-1 Entropy7-2 Increase of entropy principle7-3 Entropy change of pure substances7-4 Isentropic processes7-5 Property diagrams involving entropy | Ch-7 |
|  12 | 7-6 What is entropy?7-7 T-ds relations7-8 Entropy change of liquids and solids7-9 The entropy change of ideal gases | Ch-7 |
|  13 | 9-1 Basic considerations9-2 Value of carnot cycle9-3 Air standard assumptions9-4 An overview of reciprocating engines9-5 Otto Cycle (spark ignition engines) | Ch-9 |
|  14 | 9-6 Diesel Cycle (compression ignition engines)9-7 Stirling and ericsson cycle9-8 Brayton cycle (gas turbine engines) | Ch-9 |
|  15 | 9-11 Ideal jet propulsion cycle10-2 Rankine cycle (vapor power cycle) | Ch-9 & Ch-10 |
| 16 | **Final Examination** |  |