**Department of Physics, School of Science,**

**University of Management and Technology**

**Course Outline**

Course code:PH 205 Course Title: HEAT and THERMODYNAMICS

|  |  |
| --- | --- |
| Program | BS PH/BSc Aircraft Maintenance Engineering Technology/BS MA |
| Credit Hours | 02 |
| Duration | 16 weeks |
| Prerequisites | NA |
| Resource Person | Dr. Sidra Khalid |
| Counseling Timing  (Room# 3S-38 Hall room 3) | Displayed on lms |
| Contact | Sidra.khalid@umt.edu.pk |

**Faculty Signature ……………………. Date……………………………………………..**

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

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

**Learning Objective:**

This course has two parts. In part 1, introduction and basic concepts in thermodynamics will be covered through understanding and application of 1st Law of thermodynamics. Familiarity with of 2nd law of thermodynamics with Carnot principles and applications in aircraft propulsion systems will also be covered. In part 2, fundamental mechanisms of Heat Transfer will be covered along with application of 1-D heat conduction equation.

Upon successful completion of the course, the student should be able to:

|  |  |  |  |
| --- | --- | --- | --- |
| **S No** | **CLO Statement** | **PLO** | **Learning Domain and level** |
|  | ***Explain*** the fundamental principles of thermodynamics and their applications to heat engines and refrigerators. | 1 | C2 |
|  | ***Apply***the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components  (Pumps, turbines, pistons, etc.) to estimate required balances of heat, work and energy flow. | 1 | C4 |
|  | ***Able*** to understand the basics of heat  transfer Mechanisms along with application of 1-D heat  Conduction equation. | 3 | C3 |

1. **CLO – PLO MAPPING:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CLOs** | **PLOs** | | | | | | | | | | | |
| Engineering Technology Knowledge | Problem Analysis | Design / Development of Solutions | Investigation | Modern Tool Usage | The Engineering Technologist and Society | Environment and Sustainability | Ethics | Individual and Team Work | Communication | Project Management | Lifelong Learning |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | **C2** |  |  |  |  |  |  |  |  |  |  |  |
| 2 |  | **C4** |  |  |  |  |  |  |  |  |  |  |
| 3 |  |  | **C3** |  |  |  |  |  |  |  |  |  |

**Learning Methodology:**

* The course content is designed as a mixture of theory lectures and web tutorials.
* Participants will be evaluated based on assignments and quizzes from theory, worked examples and individual/group presentations/projects.
* Some laboratory experiments will be designed as a part of course to ensure active participation and consolidate learning.

**Recommended Text Books:**

**Book 1**: THERMODYNAMICS” An Engineering Approach, by Yunus A. Cengel and Michael A. Boles, Seventh

Edition, Tata McGraw Hill, 2008.

**Book 2**: HEAT TRANSFER A Practical Approach; by Yunus A. Cengel and Michael A. Boles, Second Edition,

McGraw-Hill Companies, 2007.

**Reference Books:**

Fundamentals of Engineering Thermodynamics, Third Edition, by Michael J. Moran and Howard N. Shapiro, John Wiley & Sons.

**Grade Evaluation Criteria**

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

|  |  |
| --- | --- |
| **Marks Evaluation** | **Marks in percentage** |
| Quizzes/Assignments(x8)/project | 30 |
| Mid Term Examination | 30 |
| End Term Examination | 40 |
| **Total** | 100 |

Assignments and quizzes: Problems will be assigned and quizzes will be given at regular intervals during the semester.

Mid-Term examination: This will cover all the material covered during the period between 1st lecture and 14th lecture.

Final examination: This will cover all the material covered during the semester.

ATTENDANCE POLICY: Students missing more than 20% of the lectures will receive an “**SA**” grade in the course.

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

**Course code: PH-205 Course title: Heat and Thermodynamics**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Week** | **Course Contents** | | **Chapter(s) & Sections** | **Quiz** | **Assignments** | **CLOs** | |
| 1 | Thermodynamics and energy  Temperature and the zeroth law of thermodynamics **Book 1** | | Ch. 1  1 - 5  6 – 8 |  |  | 1 | |
| 2 | Pressure  Forms of energy and energy transfer  **Book 1** | | Ch. 1,2  9 - 11  1 - 4 |
| 3 | Forms of work and first law of thermodynamics  Energy and environment **Book 1** | | Ch. 2  5 - 7  8 | 1 |  | 1 | |
| 4 | Phases of a pure substance  Property diagrams for phase-change processes **Book 1** | | Ch. 3  1 - 3  4 |
| 5 | Enthalpy – A combination property  The ideal gas equation of state  **Book 1** | | Ch.3  5-6 | 1 | 1 | | 2 |
| 6 | Energy analysis of closed systems  Specific heats  **Book 1** | | Ch.4  1 – 2  3 - 4 | 1 |  | 2 | |
| 7 | Internal energy and enthalpy  Mass and energy analysis of control volumes  **Book 1** | | Ch. 4,5  5  1 - 3 | 1 |  | 2 | |
| 8 | | **Mid Term Examination** | | | | | |
| 9 | | Nozzles and diffusers  Turbines, compressors, and throttling valves **Book 1** | Ch.5  4 | 1 | 1 | 2 | |
| 10 | | Introduction to second law of thermodynamics  Heat engines, refrigerators, and heat pumps **Book 1** | Ch.6  1 - 3  4 |
| 11 | | Carnot Cycle, Carnot Principles, and Carnot Heat Engine, The thermodynamic temperature scale  **Book 1** | Ch. 6  6 - 8  9 – 10 |  |  | 2 | |
| 12 | Otto Cycle & Diesel Cycle  Brayton Cycle: For gas-turbine engines  **Book 1** | | Ch. 9  1 – 4  5 – 6, 8 | 1 |  | 2 | |
| 13 | The Brayton Cycle with Regeneration, Intercooling, Reheating, Ideal Jet-Propulsion Cycles **Book 1** | | Ch. 9  9 – 11 |  |  | 2 | |
| 14 | Thermodynamics and Engineering Heat Transfer  Heat Transfer Mechanisms (Conduction)  Convection & Radiation  **Book 2** | | Ch. 1  1 – 1 & 2  1 – 5 & 6  1 – 7 & 8 |  |  | 3 | |
| 15 | Simultaneous Heat Transfer Mechanisms  Problem-Solving Techniques  Steady versus Transient Heat Transfer, Heat Generation  **Book 2** | | Ch. 1  1 – 9  1 - 10  Ch.2  2 – 1 |  |  | 3 | |
| 16 | Plane Wall Heat Conduction, B C & Solution  The Thermal Resistance Concept and Fin Equation  **Book 2** | | Ch.2  2 – 2, 4, 5  Ch.3  3 – 1, 6 |  |  | 3 | |

Class Policy

**STUDENTS ARE REQUIRED TO READ AND UNDERSTAND ALL ITEMS OUTLINED IN THE PARTICIPANT HANDBOOK**

**CLASS ATTENDANCE:** Students need to be in class at the assigned time. After 10 minutes past the assigned time, the students will be marked absent.

**TURN OFF MOBILE PHONE**! It is unprofessional to be texting or otherwise.

**READ EMAILS!** Participants should regularly check their university emails accounts regularly and respond accordingly. Students would be responsible if they miss a deadline because of not reading the emails.

**CLASS ATTENDANCE POLICY:** A minimum of 80% attendance is required for a participant to be eligible to sit in the final examination. Being sick and going to weddings is absence and will not be counted as present. Participants with less than 80% of attendance in a course will not be allowed to take end term exams. International students who will be leaving for visa during semester should not use any days off except for visa trip to avoid reaching short attendance.

**MOODLE:** UMT –LMS (Moodle) is an Open Source Course Management System (CMS), also known as a learning Management System (LMS). Participants should regularly visit the course website on MOODLE Course Management system, and fully benefit from its capabilities. In case of any problem while using MOODLE, visit <http://oit.umt.edu.pk/moodle>. For queries email [moodle@umt.edu.pk](mailto:moodle@umt.edu.pk)

**HARASSMENT POLICY:** Sexual or any other harassment is prohibited and is constituted as punishable offence. Sexual or any other harassment of any participant will not be tolerated. All actions categorized as sexual or any other harassment when done physically or verbally would also be considered as sexual harassment when done using electronic media such as computers, mobiles, internet, emails etc.

**USE OF UNFAIR MEANS/ HONESTY POLICY:** Any participant found using unfair means or assisting another participant during a class test/quiz, assignments or examination would be liable to disciplinary action.

**PLAGIARISM POLICY:** All students are required to attach a “Turnitin” report on every assignment, big or small. Any student who attempts to bypass “TurnItin” will receive “F” grade which will count towards the CGPA. The participants submit the plagiarism report to the resource person with every assignment, report, project, thesis etc. If student attempts to cheat Turnitin, a second “F” will be awarded that will count towards the CGPA. There are special rules on plagiarism for final reports etc. all outlined in your handbook.

**COURSE WITHDRAWAL POLICY:** Students may withdraw from a course till the end of the 12th week of the semester. Consequently, grade ‘W’ will be awarded to the student which shall have no impact on the calculation of the GPA of the student. A Student withdrawing after the 12th week shall be automatically awarded “F” grade which shall count in the GPA.

**COMMUNICATION OF RESULTS:** The results of quizzes and assignments are communicated to the participants during the semester and answer books are returned. It is the responsibility of the course instructor to keep the participants informed about his/her progress during the semester. The course instructor will inform a participant at least one week before the final examination related to his or her performance in the course.