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**Department of Physics**

**College of Science**

**University of Salahaddin**

**Subject: Heat and Thermodynamics**

**Course Book – (2nd – General physics)**

**Lecturer's name *Abdulrhman.KH.Suliman***

**Academic Year: 2023/2022**

**Course Book**

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| **1. Course name** | **Heat and Thermodynamics** | |
| **2. Lecturer in charge** | **Abdulrhman.KH.Suliman** | |
| **3. Department/ College** | **Scince/ physics** | |
| **4. Contact** | **e-mail:** [abdulrahman.suliman@su.edu.krd](mailto:abdulrahman.suliman@su.edu.krd)  **Tel: 0750 143 8216** | |
| **5. Time (in hours) per week** | **Theory: 3**  **Practical: 8** | |
| **6. Office hours** | **10** | |
| **7. Course code** |  | |
| **8. Teacher's academic profile** | **I have more than 20 year experience teaching of different subjects such as;- MEDICAL PHYSICS, HEAT & THERMODYNAMIC, and METHOD OF RESEARCH, thermodynamic lab, atomic lab, nuclear lab, electricity lab, electrical measurement lab and physiology lab. also I have four(5) papers are published in different foreign journals.. Participation in different conferences and meeting. I worked in radiology filed too,**  **B.Sc. of Physics from 1994**  **M.Sc. of** [Nanoscience:](https://www.science.org.au/curious/nanoscience) **[from 2006](https://www.science.org.au/curious/nanoscience)**  **Assist Lecturer** Oct 2006 – March 2011  **Instructor** Feb 2012 – up to date  **Assist Prof.** …2018………. | |
| **9. Keywords** | **Heat, four thermodynamics law, Physics of heat transfer, Concepts And Applications** | |
| **10. Course overview:**  These course give the student the usefulness of physics in understanding the relation between heat work and energy , A branch of physics, thermodynamics is the study of **the relationship between properties of heat, temperature, energy, and work**. Central to that relationship and to the laws of thermodynamics are the concepts of entropy and the Internal Energy Formula.  The laws of thermodynamics describe how the energy in a system changes and whether the system can perform useful work on its surroundings | | |
| **11. Course objective:**  THERMODYNAMICS: COURSE INTRODUCTION Course Learning Objectives: **To be able to use the First Law of Thermodynamics to estimate the potential for thermo-mechanical energy conversion in aerospace power and propulsion systems**. ****  ****Develop scientific communication skills.. | | |
| **12. Student's obligation**  **By the end of the course, students will be expected to be able to…**  **Describe an imaging different type of system and break it down into its components and physical principles of instruments ,**  ****The objectives of thermodynamics are: **To improve the efficiency of a process for the transformation between energy and work**. To study energy conversion in different forms. To study the entropy of a system. لێره‌ مامۆستا به‌رپرسیارێتی قوتابی خوێندکار ڕوونده‌کاته‌وه‌ سه‌باره‌ت به‌ کۆرسه‌که‌ بۆ نموونه‌ ئاماده‌بوونی قوتابیان له‌ وانه‌کاندا، له‌ تاقیکردنه‌وه‌کاندا، راپۆرت و ووتار نووسین... هتد. | | |
| **13. Forms of teaching**  **Our lecture is depend directly on showing the strong point in the lecture via data show depending on the power point program… seminar for different subject of thermodynamic**  لێره‌ مامۆستا ڕێگه‌ی وانه‌‌ ووتنه‌وه‌ ده‌نووسێت، بۆ نموونه‌:‌ داتاشۆ و پاوه‌رپۆینت، ‌سه‌ر ته‌خته‌ڕه‌ش، ته‌خته‌ی سپی، سمارتبۆرد یان‌ مه‌لزه‌مه‌... هتد | | |
| **14. Assessment scheme**  **All exams have 60 marks, QUAIZE has 5 marks, the classroom activities count and for attendance 5 Marks. So that the final grade will be based upon the following criteria:**  **Mid- semester exam: 30%**  **Classroom participation and assignments: 5%**  **QUIAZE: 5%**  **Final Exam: 60% .**  Breakdown of overall assessment and examination  لێره‌ مامۆستا جۆری هه‌ڵسه‌نگاندن (تاقیکردنه‌وه‌کان یان ئه‌زموونه‌کان) ده‌نووسێت بۆ نموونه‌ تاقیکردنه‌وه‌ی مانگانه‌، کویزه‌کان، بیرکردنه‌وه‌ی ڕه‌خنه‌گرانه (پریزه‌نته‌یشن)، ڕاپۆرت نووسین، ووتار نووسین‌ یان ئاماده‌نه‌بوونی خوێندکار له‌ پۆلدا...هتد. ئامانه‌ چه‌ند نمره‌ی له‌سه‌رده‌بێت و مامۆستا چۆن نمره‌کان دابه‌شده‌کات؟‌ | | |
| **15. Student learning outcome:**   * Thermodynamic plays a very important role in the Physics field, he students will be able to, define the basic terms in thermodynamics .   **restate defination of system, surrounding, closed and open system, extensive and intensive properties**. calculate absolute and gage pressure, and absolute temperature. calculate changes in kinetic, potential, enthalpy and internal energy.  applications of thermodynamics?  **Thermal power plants, nuclear power plants, hydroelectric power plants, and power plants based on renewable energy sources such as solar, wind, geothermal, tides, and water waves** are all studied in thermodynamics.  . As a consequence, the challenge was to try to get them interested in the field whatever their future goals were..  پڕکردنه‌وه‌ی ئه‌م خانه‌یه‌ زۆر گرنگه‌، مامۆستا ده‌رئه‌نجامه‌کانی فێربوون ده‌نووسێت. بۆ نموونه‌: ڕوونی ئامانجه‌ سه‌ره‌کیه‌کانی کۆرسه‌که‌ (بابه‌ته‌که‌) بۆ خوێندکار‌  گونجاندنی ناوه‌ڕۆکی کۆرسه‌که‌ به‌ پێویستی ده‌ره‌وه‌ و بازاڕی کار  قوتابی چی نوێ فێرده‌بێت له‌ ڕێگه‌ی پێدانی ئه‌م کۆرسه‌وه‌؟  This should not be less than 100 words | | |
| 16. Course Reading List and References‌:  Books: There are many good introductory texts on medical physics, for example:   * 1- **Thermodynamics --- by**  **F. SEARS**   2- **Thermodynamics, kinetic theory, and statistical thermodynamics**  By ; Sears. Salinger  3- الحرارة والثرموداينميك د امنة احمد رمزي  5- الثرمودابميك د- سامي مظلوم  ▪ Key references:  ▪ Useful references:  ▪ Magazines and review (internet): | | |
| 17. The Topics: | | **Lecturer's name** |
| **Week 1:- 20/9/ 2022 [Thermodynamic Relationships]**  **]**  1.1 **1-1 Thermodynamic Variables.**  **1-2 Fundamental concepts of Thermodynamics.**  **1-3 Types of Thermodynamic Systems.**  **1-4 Types of Thermodynamic process.**  **1-5 Types of Thermodynamic walls.**  **1-6 Thermodynamic equilibrium.**  **1-7 concept of heat and temperature**  **Week 2:- 25/10/2022 [Thermometry]**  2-1 thermometer  2-2 Types of Thermometer  2-3 Centigrade- Kelvin- Fahrenheit – Rankin scales  2-4 Relation between Clausius, Kelvin, Fahrenheit, and Rankin scales  2-5 Concept of Absolute Zero.  2-6 A constant Volume Gas Thermometers.  2-7 A Platinum Resistance Thermometers.  2-8 Pyrometers  2-9 Thermo-electric Thermometers.  2-10 A Comparison of types of Thermometers.  2-11 The advantage and disadvantage of Liquid Thermometer.  2-12 Thermo-electric effect  2-12-a Seeback effect.  2-12-b Peltries effect.  2-13 Standardization and Temperature  **Week 3:- 20/11/2022 [Thermal Expansion]**  3.1 **3-1 Thermal Expansion in Solids and Liquids.**  **3-2 Atomic bonding in solids.**  **3-3 The mechanisms of thermal expansion.**  **3-4 Thermal expansion of solids in 1D,2D, and 3 Dimension.**  **Week 4:- 15/12/2022 [Heat Transfer]**  **]**  4-1 Thermal Conduction.  4-2 Some types of Heat Flow.  4-3 Heat flow through a uniform flow.  4-4 Spherical shell method (Radial flow of heat).  4-5 Cylindrical flow of a Heat .  4-6 Heat flow through a compound wall.  4-7 Convection.  4-8 Radiation.  4-9 Black Body.  4-10 Stefan- Boltzmann law.  4-11 Newton law of cooling  4-12 Wines law.  **Week 5:- 11/2/2022 [Radiosurgery-1**  5-1 Basic Postulate of Kinetic theory.  5-2 Equation of State.  5-3 Concept of Ideal gas or Perfect gas.  5-4 Equation of State of Ideal gas.  5-5 Boyle's law.  5-6 Charles law.  5-7 Gay -Lussac law.  5-8 Avogadro's law.  5-9 Daltons law.  5-10 Joules law.  5-11 Experimental method for determining the equation of state of Ideal gas.  5-12 Equation of State of Real gas.  5-13 Van Der Walls equation of state.  5-14 Andrew's Experiment n Carbon Dioxide.  5-15 Comparison with Experimental P-V curves.  5-16 Critical Coefficients.  5-17 Correction for Intermolecular attraction.  5-18 Correction of the size of molecular.  5-19 Reduced Equation of state.  5-20 Properties of Matter near Critical Coefficient.  5-21 Defect in Van-Der-Walls equation.  **Week 6:- 1/3/2022 [CHANGE OF STATE]**  6-1 p-v-t Surface of Real gas.  6-2 Heat capacity.  6-3 Calorimeter.  6-4 Latent Heat of Fusion and Vaporization.  6-5 Laws of Fusion.  6-6 Laws of Boiling.  6-7 Change of state of substance.  6-8 Kinetic Theory of Latent heat.  6-9 Effect of Pressure on Freezing point.  6-10 Change in boiling point with pressure.  **Week 7:- 20/3/2021 [LAWS OF THERMODYNAMIC]**  77-1 Zeroth law of Thermodynamic.  7-2 Concept of Heat.  7-3 Work: - A path dependent function.  7-4 Internal Energy (U).  7-5 First law of Thermodynamic.  7-6 Work done during an isolated process.  7-7 Work done during an adiabatic process.  7-8 Some consequence of first law of Thermodynamic.  **Week 11: - 1/4/2022 [MATHEMATICAL PROPERTIES OF STATE FUNCTION]**  8-1 Relationship between partial derivatives.  8-2 The coefficient of Expansion and Compression.  8-3 Heat added to or removed from A Thermodynamic system.  8-4 Specific Heat of gas.  8-5 Specific heat of Ideal gas.  8-6 Relation between Cp and Cv and .  8-7 Dolong-Petit law.  8-8 The Coefficient of volume Expansion and Compression of Van-Der-Walls gas  8-9 Enthalpy.  8-10 Reversible adiabatic process.  8-11 Slops of adiabatic and isothermal process.  8-12 Work done during adiabatic expansion.  **Week 12: - 26/4/2022 [THE SECOND LAW OF THERMODYNAMIC**  **]**  9-1 Joule- Experiment (free expansion).  9-2 Joule- Kelvin experiment.  9-3 Heat Engine.  9-4 Efficiency and Performance of Heat engine.  9-5 Refrigerator and Refrigerator cycle.  9-6 Indictor diagram of refrigerator.  9-7 Carnot cycle.  9-8 Efficiency of Carnot cycle.  9-9 The Ideal heat engine.  9-10 The Clausius statement of the second law.  9-11 The Kelvin- Planck statement.  9-12 Internal Composition engine (Diesel cycle and Otto cycle).  9-13 Efficiency of Gasoline engine.  9-14 Theoretical Diesel cycle or constant pressure cycle. | | Abdulrhman alassafee  ex: (3 hrs)  ex: 20/9/2022 |
| **18. Practical Topics (If there is any)** | |  |
| In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture | | Lecturer's name; Abdulrhman alassafee  ex: (2 hrs)  ex: 1/11/2022 |
| Typical examination Of heat and thermodynamics  **Q1/** Show the difference between Ideal gas and Real gas (3 marks)  **Q2/** A hollow copper cylinder are filled to the top with water at (20C). If the water and container heated to a temperature of (91C). what percentage of the water spills over the top of the container.  [βcu =48×10-6C-1 ,βH2O=207×10-6 C-1] (4marks)    **Q3/** On the phase diagram, (7marks)  **A/** what represent two circles on the diagram. **B/** what happens to the boiling point temperature of water as you go the higher elevations in the mountain. **C/** Is ice less dense or more dense than liquid water.  D/ show the region of solid, liquid, and gas on the diagram.    **Q4**/ From the figure;- 1- is the final temperature higher than, lower than, or equal to the initial temperature. 2- is the work done of gas positive or negative, explain, 3- show on the figure how you would determine the amount of work done. 4- Is any heat energy added to or removed from the system in this process explained. (4marks)    **Q5**/ could you have a heat engine with efficiency [ µ >1] ?explain (3marks)  **Q6**/ Two thermodynamic cycles are shown, which cycle has a larger thermal efficiency? Explain  (4marks) | |  |
| 20. Extra notes:  Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks. | |  |
| 21. Peer review پێداچوونه‌وه‌ی هاوه‌ڵ  This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.  (A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).  ئه‌م کۆرسبووکه‌ ده‌بێت له‌لایه‌ن هاوه‌ڵێکی ئه‌کادیمیه‌وه‌ سه‌یر بکرێت و ناوه‌ڕۆکی بابه‌ته‌کانی کۆرسه‌که‌ په‌سه‌ند بکات و جه‌ند ووشه‌یه‌ک بنووسێت له‌سه‌ر شیاوی ناوه‌ڕۆکی کۆرسه‌که و واژووی له‌سه‌ر بکات.  هاوه‌ڵ ئه‌و که‌سه‌یه‌ که‌ زانیاری هه‌بێت له‌سه‌ر کۆرسه‌که‌ و ده‌بیت پله‌ی زانستی له‌ مامۆستا که‌متر نه‌بێت.‌‌ | |  |
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