**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification. |

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| University of Baghdad | 1. Teaching Institution |
| College of Engineering/Energy Dept. | 2. University Department/Centre |
| 211ENT | 3. Course title/code |
| BSc. | 4. Programme(s) to which it contributes |
| Weekly | 5. Modes of Attendance offered |
| Yearly | 6. Semester/Year |
| 90 hours | 7. Number of hours tuition (total) |
| 2016 | 8. Date of production/revision of this specification |
| 9. Aims of the Course the course covers the | |
| 1-Introduction to thermodynamic | |
| 2-thermodynamic definitions and concepts | |
| 3-thermodynamic coordinates units and tables of properties | |
| 4- Work and Heat | |
| 5- first law of thermodynamics | |
| 6- heat engine, refrigerator and heat pump | |
| 7- second law of thermodynamics | |
| 8- entropy | |
| 9-some power and refrigeration cycles | |

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| 10· Learning Outcomes, Teaching ,Learning and Assessment Method |
| 1. Knowledge and Understanding   A1.To know basic thermodynamic concepts.  A2.To understand the relation between mass and energy,  A3.To know how to determine the complete system description  A4.To understand system behavior due to interaction with the surrounding.  A5. To understand the entropy concept.  A6 .To know how analyze different thermodynamic systems and cycles. |
| B. Subject-specific skills  B1.Analyze and give a complete description to any thermodynamic cycle,  B2.Application of  B3. |
| Teaching and Learning Methods |
| 1- Lecturing 2- Team work 3- home work 4- laboratory work |
| Assessment methods |
| practical and theoretical tests, quizzes quarterly and final tests |
| C. Thinking Skills  C1.Disscusion and conclusion  C2.Thermodynamic module description  C3.Analyze and solving problems  C4. |
| Teaching and Learning Methods |
| Providing students a knowledge of engineering skill in thermodynamic. .1-  2-To make the students have the ability of scientific analysis methods |
| Assessment methods |
| Lecture/discussion/learning/experiential learning application |

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| D. General and Transferable Skills (other skills relevant to employability and personal development)  D1.Confidence and courage to grant entry to the working field.  D2.Students gain the courage to take decisions  D3.  D4. |

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| 11. Course Structure | | | | | |
| Assessment Method | Teaching  Method | Unit/Module or Topic Title | ILOs | Hours | Week |
| Testing | Lecture and discussion | Introduction | To recognize thermodynamic definition (with power plant and refrigerator example) | 3 hours | First |
| Testing | Lecture and discussion | Thermodynamic concepts,Zeroth law of thermodynamic | To recognize some thermodynamics concept ( system, process,properties..etc) | 3 hours | Second |
| Testing | Lecture and discussion | Thermodynamic quantities and SI units | Intensive and extensive properties and related SI units | 3 hours | Third |
| Testing | Lecture and discussion | Properties of pure substances | Saturation lines ,compressed , wet and super heated region | 3 hours | Fourth |
| Testing | Lecture and discussion | Properties of pure substances (steam tables) | Dryness fraction, PTV surface ,critical and triple point | 3 hours | fifth |
| Testing | Lecture and discussion | Ideal gas Equations | To recognize the ideal gas behavior | 3 hours | sixth |
| Testing | Lecture and discussion | Real gas equation and compressibility chart | Van der Wall and other real gas equations, reduced coordinates | 3 hours | seventh |
| Testing | Lecture and discussion | Heat and work | To recognize different closed system work | 3 hours | eight |
| Testing | Lecture and discussion | Work and specific heat | To recognize open system work and specific heat for pure substance and gas | 3 hours | ninth |
| Testing | Lecture and discussion | Conservation of mass and conservation of heat | To recognize the continuity equation and general form energy equation | 3 hours | tenth |
| Testing | Lecture and discussion | Energy equation for cycle and closed system | To recognizeJoul experiment application of closed system first low, internal energy concept | 3 hours | eleventh |
| Testing | Lecture and discussion | Open system first lsw | To recognize the flow work kinetic and potential energies | 3 hours | twelfth |
| Testing | Lecture and discussion | Steady state steady flow(SSSF equation) | To recognize SSSF equation for many engineering application | 3 hours | thirteenth |
| Testing | Lecture and discussion | Uniform flow uniform state (UFUS) | To recognize filling and evacuation | 3 hours | fourteenth |
| Testing | Lecture and discussion | First term exam | Cover all the above subjects | 3 hours | fifteenth |
| Testing | Lecture and discussion | Heat engine and refrigeration | To recognize Heat engine and refrigeration and heat pump concept | 3 hours | sixteenth |
| Testing | Lecture and discussion | Reversible and irreversible processes | To recognize irreversibility the factors effecting reversibility | 3 hours | seventeenth |
| Testing | Lecture and discussion | Carnot heat engine | To recognize the importance of the Carnot cycle ( for heat engine and refrigerator) | 3 hours | eighteenth |
| Testing | Lecture and discussion | Clausius and Gilvin Plank statements | To recognize the two statements and their equivalence | 3 hours | nineteenth |
| Testing | Lecture and discussion | Second low of thermodynamic , entropy | To recognize entropy as a thermodynamic proprties | 3 hours | twentieth |
| Testing | Lecture and discussion | Clausiusinequlity | To recognize this inequality statement for any cycle | 3 hours | Twentieth-one |
| Testing | Lecture and discussion | Entropy as a properties | To recognize entropy as a point function, entropy for pure substance | 3 hours | Twentieth-two |
| Testing | Lecture and discussion | Entropy for perfect and real gas | To recognize perfect and real gas entropy calculation (tables) | 3 hours | Twentieth-three |
| Testing | Lecture and discussion | Entropy for open system | To recognizeentropy change for SSSF and UFUS processes | 3 hours | Twentieth-four |
| Testing | Lecture and discussion | Third law of thermodynamic | To recognize relation between system and universe | 3 hours | Twentieth-five |
| Testing | Lecture and discussion | Rankle power cycle | To recognize slandered steam power plant cycle | 3 hours | Twentieth-six |
| Testing | Lecture and discussion | Reheat power cycle | To recognize the improvement of steam power cycle | 3 hours | Twentieth-seven |
| Testing | Lecture and discussion | Vapor compression refrigeration cycle | To recognize standard vapor compression expansion refrigeration cycle | 3 hours | Twentieth-eight |
| Testing | Lecture and discussion | Otto and Diesel cycles | To recognize the air standard power cycles | 3 hours | Twentieth-nine |
| Testing | Lecture and discussion | Second term exam | Cover all the second term subjects | 3 hours | Thirty |

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| Fundamental of classical thermodynamics/By:Van Wylenand Sonttag , Fifth edition John Wiley & sons inc.  Fundamental of thermodynamics/ By: Sonttag,Borgnakke and Van Wylen , Fifth edition John Wiley & sons inc. | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER |
|  | Special requirements (include for example workshops, periodicals, IT software, websites) |
|  | Community-based facilities  (include for example, guest  Lectures , internship , field studies) |

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| 13. Admissions | |
|  | Pre-requisites |
|  | Minimum number of students |
|  | Maximum number of students |