**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**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 anddemonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programmed specification. |

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| College of Engineering  University of Baghdad | ***1. Teaching Institution*** |
| Mechanical Engineering Department (MED) | ***2. University Department/Centre*** |
| Thermodynamics – ME203  This course introduces the basics of thermodynamics. Topics covered: Basic principles and definitions; Heat, Work, Power, Internal Energy, Enthalpy, Zeroth Law Of Thermodynamic, Temperature And Its Measurements, 1st Law Of Thermodynamic, Boyle ’s Law, Charles’s Law, Perfect Gas Law, Closed Systems Processes, Open Systems Processes, Energy Equation For Steady Flow And Its Applications, Reversible And Irreversible Processes, Heat Engine And Reversible Heat Engine, 2nd Law Of Thermodynamic, Carnot Cycle And Reversed Carnot Cycle, Entropy, Clauses Inequality, Gases Mixtures, Cycles. The course is taught through 4 hrs per week, 2  theories, 1 tutorial, and 1 experimental. | ***3. Course title/code& Description*** |
| Mechanical Engineering ( ME ) | ***4. Programme(s) to which itContributes*** |
| Annual System ; There is only one  mode of delivery, which is a “Day  Program”. The students are full time students, and on campus. They attend full day program in face-to-face mode. The academic year is  composed of 30-week regular subjects. | ***5. Modes of Attendance offered*** |
| 1st & 2nd / Academic Year 2018 – 2019 | ***6. Semester/Year*** |
| 120 hrs. / 4 hrs. per week | ***7. Number of hours tuition (total)*** |
| October – 20 / 2018 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** | |
| 1. Introduce an efficient treatment of classical thermodynamics by designing the course in such a manner that prepares the student to participate in the real engineering work. 2. Illustrate the basic principles and definitions. 3. Explain the importance of the use of thermodynamic tables and charts to identify the state and process. 4. Define the first and the second law of thermodynamics and the Carnot Cycle with their engineering applications. 5. Introduce the concept of entropy and show its use for thermodynamic analysis. 6. Employ the basic knowledge in the real world energy systems that including gas power cycles and vapor power cycles. 7. Provide a strong physical and analytical understanding of thermodynamics in order to function in the capacity of mechanical engineer in an engineering company dealing with power plants. 8. Provide a background to higher level courses involving thermodynamics and heat transfer. | |

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| ***10·Learning Outcomes***  At the end of the class, the student will be able to :   1. Understand and define the following terms: thermodynamic system, surrounding, boundary, closed system, open system, isolated system, control mass, control volume, process, cycle, extensive and intensive properties. To identify units of pressure, temperature, density, and mass, SI and English, and to use conversions. 2. Explain what is meant by saturated liquid, compressed liquid, saturated vapor, super heated vapor, saturated liquid-vapor mixture, critical point and triple point, and be able to identify them on T-v and P-v diagrams. To know how to use thermodynamic tables and diagrams and how to obtain specific volume, enthalpy, and internal energy from them directly or interpolate the data using linear interpolation. To understand and apply the ideal gas equation of state. 3. Understand what is meant by process and path of the process and be able to define isothermal, isobaric, isochoric processes. To understand that the area under the process curve on a P-v diagram represent the boundary work, and how to calculate the boundary work. 4. Understand that heat and work are energies in transition i.e. a boundary phenomenon and they will be able to apply mass and energy balances (First Law of thermodynamics) to a variety of simple processes and circumstances. To understand that the magnitude of heat and work depend on the path followed by the process i.e. a path function. 5. Solve problems using steady flow energy equation (first law of thermodynamics) for different devises such as: nozzle, diffuser, turbine, compressor, pump, heat exchanger, mixing chamber, and throttling valve. To analyze the unsteady state problems. 6. Define the Kelvin and Clausius statements of second law of thermodynamics and appreciate that a process will not occur unless it satisfies both the first and the second law of thermodynamics. To identify heat engines, refrigerator and heat pump, and calculate the thermal efficiency and the COP of heat engine and refrigerators. To describe the four reversible processes of Carnot cycle on a P-v diagram and to compare its efficiency with the actual cycle to compute the maximum possible efficiency of the actual cycle. 7. State the Clausius inequality and know that any process violates clausius inequality will also violate the second law of thermodynamics. To know that entropy is a thermodynamic property and how to obtain it from thermodynamic tables and diagrams. To know the meaning of isentropic processes. To know the increase of entropy principle. 8. Define the meaning of efficiencies in nozzles, turbines, compressors, and pumps, and use them to solve problems. 9. Define and analyze some thermodynamic cycles such as: Rankine cycle, Reheat cycle, Vapor-Compression Refrigeration Cycle, Otto cycle and Diesel cycle. |
| ***11.Teaching and Learning Methods*** |
| 1. Lectures.  2. Tutorials.  3. Homework and Assignments.  4. Lab. Experiments.  5. Tests and Exams.  6. In-Class Questions and Discussions.  7. Connection between Theory and Application.  8. Field Trips.  9. Extracurricular Activities.  10. Seminars.  11. In- and Out-Class oral conservations.  12. Reports, Presentations, and Posters. |
| ***12. Assessment Methods***  1. Examinations, Tests, and Quizzes.  2. Extracurricular Activities.  3. Student Engagement during Lectures.  4. Responses Obtained from Students, Questionnaire about Curriculum and Faculty Member ( Instructor ). |
| ***13. Grading Policy***    1. Quizzes:  - There will be a ( 15 – 20 ) closed books and notes quizzes during the academic year.  - The quizzes will count 20% of the total course grade.  2. Tests, 2-3 Nos. and will count 10% of the total course grade.  3. Extracurricular Activities, this is optional and will count extra marks ( 1 – 5 % ) for the student, depending on the type of activity.  4. Final Exam:  - The final exam will be comprehensive, closed books and notes  - The final exam will count 70% of the total course grade |

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| ***14. Course Structure*** | | | | | |
| Assessment  Method | Teaching  Method | Unit/Module or  Topic Title | LOs  ( Article  10 ) | Hours | Week |
| 1 – 4 of article (12) | 1-12 of  article (11) | Some Introductory Comments | a,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 1 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Some Introductory Comments | a,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 2 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Some Concepts And Definitions | a,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 3 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Some Concepts And Definitions | a,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 4 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Some Concepts And Definitions | a,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 5 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Properties of a Pure Substance | b,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 6 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Properties of a Pure Substance | b,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 7 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Properties of a Pure Substance | b,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 8 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Properties of a Pure Substance | b,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 9 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Work and Heat | b,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 10 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Work and Heat | b,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 11 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Work and Heat | b,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 12 |
| 1 – 4 of article (12) | 1-12 of  article (11) | The First Law of Thermodynamics | c,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 13 |
| 1 – 4 of article (12) | 1-12 of  article (11) | The First Law of Thermodynamics | c,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 14 |
| 1 – 4 of article (12) | 1-12 of  article (11) | The First Law of Thermodynamics | c,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 15 |
| 1 – 4 of article (12) | 1-12 of  article (11) | First-Law Analysis for a Control Volume | d.l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 16 |
| 1 – 4 of article (12) | 1-12 of  article (11) | First-Law Analysis for a Control Volume | d,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 17 |
| 1 – 4 of article (12) | 1-12 of  article (11) | First-Law Analysis for a Control Volume | d,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 18 |
| 1 – 4 of article (12) | 1-12 of  article (11) | The Second Law of Thermodynamics | e,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 19 |
| 1 – 4 of article (12) | 1-12 of  article (11) | The Second Law of Thermodynamics | e,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 20 |
| 1 – 4 of article (12) | 1-12 of  article (11) | The Second Law of Thermodynamics | e,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 21 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Entropy | f,h,l,m,n,o,p,q,r | 4  2 the.  1 tut.  1 exp. | 22 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Entropy | f,h,l,m,n,o,p,q,r | 4  2 the.  1 tut.  1 exp. | 23 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Entropy | f,h,l,m,n,o,p,q,r | 4  2 the.  1 tut.  1 exp. | 24 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Entropy | f,h,l,m,n,o,p,q,r | 4  2 the.  1 tut.  1 exp. | 25 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Second-Law Analysis for a Control Volume | i,j,l,m,n,o,p,q,r | 4  2 the.  1 tut.  1 exp. | 26 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Second-Law Analysis for a Control Volume | i,j,l,m,n,o,p,q,r | 4  2 the.  1 tut.  1 exp. | 27 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Cycles | k,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 28 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Cycles | k,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 29 |
| 1 – 4 of article (12) | 1-12 of  article (11) | Cycles | k,l,m,n,  o,p,q,r | 4  2 the.  1 tut.  1 exp. | 30 |

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| ***15. Infrastructure*** | | |
| ***Textbook***  Sonntag, Borgnakke, and Van Wylen, “Fundamentals of Thermodynamics” , 7th edition, John Wiley & Sons, Inc., 2009.  ***References***   1. Y.A. Cengel & M.A.Boles   “Thermodynamics An Engineering Approach”,(5th Edition), 2008.   1. Moran, M.J. & Shapiro H.N. “Fundamentals of Engineering Thermodynamics”, 5th ed. Wiley – 2006. 2. Y.V.C Rao “Engineering Thermodynamics Through Examples”, Universities Press (India) Privet Limited, 2005. 3. Merle C. Potter,Craig W,Somerton, “Theory and Problems of Engineering Thermodynamics” ,SCHAUM’S OUTLINE SERIES Mcgraw-HILL,1993. 4. R.K. RAJPUT “Engineering Thermodynamics”, LAXMI PUBLICATIONS (P) LTD, 3rd edition, 2007.   ***Others***   1. Notebook prepared by the instructor of the course. 2. Collection of sheets of solved and unsolved problems and Exams questions | Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | |
| Laboratory experiments in the (Thermodynamic Lab) of the department.  Available websites related to the subject.  Extracurricular activities. | Special requirements (include for example workshops, periodicals, IT software, websites) | |
| Field and scientific visits.  Extra lectures by foreign guest lecturers. | Community-based facilities  (include for example, guest  Lectures , internship, field studies) | |
| ***16. Admissions*** | | |
| ME101 & ME102 Courses | | Pre-requisites |
| / | | Minimum number of students |
|  | | Maximum number of students |
| ***Instructor:***  **Dr. Mohammed Abdulraouf Nima**  Assistant professor of Mechanical Engineering / Thermo-Fluids.  Mech. Engr. Dept.  College of Engineering  University of Baghdad  Tel: 00964-7901725232  Email: dralsafi@uobaghdad.edu.iq  mnima10@gmail.com  ***Teaching Assistant:***  **Sarmad Aziz**  Lecturer of Mechanical Engineering / Thermo- Fluids  Mech. Engr. Dept.  College of Engineering  University of Baghdad  Tel: 00964-7903326829  Email: aliraqi.sarmad@yahoo.com | | ***17. Course Instructors*** |