APPENDIX A – COURSE SYLLABI

1. **Course number and name**: 0915322 Chemical Engineering Thermodynamics 2
2. Course Prerequisite: 0915321 Chemical Engineering Thermodynamics 1
3. **Credits, contact hours, and categorization of credits in Table 5-1** (math and basic science, engineering topic, and/or other): (3 Cr. – Required Course)
4. **Syllabus URL**: http://elearning.ju.edu.jo

5. **Instructor's or course coordinator's name**: Dr. Ali Khalaf Al-Matar. Office: ChE307, Telephone: 06/5355000 ext 22890, Email: aalmatar@ju.edu.jo .
6. **Textbook, title, author, and year**: Smith, J. M.; Van Ness, H. C.; and Abbott, N.M., Introduction to chemical engineering thermodynamics, 7th Edition, McGraw-Hill, New York, 1999.
    a. Sandler, S. I., Chemical, biochemical and engineering thermodynamics, John Wiley and Sons, Fourth Edition, New York, 2006.
    b. Matsoukas, T., Fundamentals of Chemical Engineering Thermodynamics, Pearson, Upper Saddle River, New Jersey, 2013.
    c. De Nevers, N., Physical and Chemical Equilibria for Chemical Engineers, John Wiley and Sons, Second Edition, New York, 2012.
    d. Journal of chemical and engineering data, http://pubs.acs.org/journal/jceaax Fluid phase equilibria http://www.journals.elsevier.com/fluid-phase-equilibria
    e. The Journal of Chemical Thermodynamics http://www.journals.elsevier.com/the-journal-of-chemical-thermodynamics/
7. **Live stream platform**: Microsoft Teams
   Live Stream URL: https://web.microsoftstream.com/video/e671b758-d51c-4d1e-8f8a-305a705cb387
   YouTube: https://www.youtube.com/channel/UC2aLJ_dDpSM-pQjuOh1R9cw
8. **Specific course information**
    a. **Catalog description** (2024 ChE Curriculum):
       Physical equilibria among phases: phase rule, vapor-liquid equilibria for various systems. Equilibrium phase diagrams. Solution thermodynamics: Properties of binary mixtures and solutions: fugacity of gases and liquids, ideal and non-ideal solutions, activity and standard states, Gibbs-Duhem equation, chemical reaction equilibrium. Use of available software.
    b. **Prerequisite**: 0915321 Chemical Engineering Thermodynamics I
    c. **Indicate whether a required, elective, or selected elective** (as per Table 5-1) course in the program: required course.
9. **Specific goals for the course**
    a. Specific outcomes of instruction (e.g. The student will be able to explain the significance of current research about a particular topic.)

i. Evaluate thermodynamic properties from pressure/volume/temperature (PVT) relations.
ii. Predict the (PVT) behavior of real fluids using equations of state (EOS) and generalized correlations. Develop from the first and second laws the fundamental property relations to estimate thermodynamics properties such as enthalpy, Gibb energy, and entropy values from PVT and heat capacity data.
iii. Develop generalized correlations, which provide estimates of property values in the absence of complete experimental information.
iv. Apply solution thermodynamics fundamentals to solve VLE problems including bubble point, dew point, and flash calculations using ideal gas and ideal solution models.
v. Understand the fundamental concepts of solution thermodynamics including chemical potential, fugacity, activity, partial molar properties, ideal/real solutions, and excess properties.
vi. Choose appropriate models for calculating real phase equilibrium.
vii. Use simulation and computational tools to estimate phase equilibria.

10. <u>Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.</u>

i. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.[1]
ii. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.[2]
iii. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.[4]

11. <u>Brief list of topics to be covered:</u>

a. Volumetric properties of pure fluids
b. Thermodynamic properties of fluids
c. Introduction to Vapor liquid equilibrium: the nature of equilibrium, the phase rule. Duhem's theorem, VLE: qualitative behavior, simple models for vapor/liquid equilibrium, VLE by modified Raoult's law, VLE from K-value correlations.
d. Theory of solution thermodynamics
e. Applications of solution thermodynamics
f. Phase equilibria with generalized models.