Thermodynamics 2

1. **Course number and name:** 020TH2NI3 Thermodynamics 2

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours

3. **Name of course coordinator:** Sami Youssef

4. **Instructional materials:** course handouts; textbook; slides; in-class problems

5. **Specific course information**
   a. **Catalog description:**
      The objective of this course is to master and apply the concepts and fundamental principles of thermodynamics. Indeed, energy in all its forms is studied in various machines, such as turbojets for aerospace and naval propulsion, gas or steam turbines, thermal power plants, and refrigeration systems. Special attention is then given to heat transfer problems. The student becomes familiar with partial differential equations and learns to manipulate the famous heat diffusion equation with or without a source term in cartesian or cylindrical geometry.

   b. **Prerequisites:** 020TH1NI2 Thermodynamics 1

   c. **Required/Selected Elective/Open Elective:** Required

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
      - Apply the laws of thermodynamics in various machines.
      - Identify the three types of heat transfer.
      - Manipulate the famous heat equation with or without internal heat generation in cartesian or cylindrical geometry.

   b. **PI addressed by the course:**

PI	1.1	1.3
Covered	x	x
Assessed	x	x

7. **Brief list of topics to be covered**
   - Course introduction (1 lecture)
   - Internal energy and entropy of a thermodynamic system, State functional formulation for infinitesimal processes (2 lectures)
   - Open system and control volume, Principle of mass conservation, Steady-state mass balance, Flow work or PV work, Steady flow energy equation (3 lectures)

- Nozzle and diffuser, Compressor and turbine, Pressure regulator (3 lectures)
- Entropy balance equation for open systems, Pressure-enthalpy diagram, Rankine and refrigeration cycles (5 lectures)
- Heat flux and heat flux density, Fourier's law, Heat equation (2 lectures)
- Wall, hollow cylinder and hollow sphere models in steady-state regime, R-value, Convective heat transfer, Newton's law (8 lectures)