# COURSE ID SHEET

| Course No. | 5309 | NTUA |
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| Semester: | 8,10 | Core | | Elective | | Specialization | X |
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Title: **ADVANCED PROCESS CONTROL**

Aim: The aim of this class is the familiarization of students with a series of modern methodologies applied to the simulation, analysis and control of multivariable processes and systems with emphasis on control using computer tools.

Content:

- Representation of systems with the help of State Variables. Equations of state of linear systems with more than one input-output. Representation of state equations as a matrix flow diagram.
- Determination of system behavior in the field of time through the solution of vector differential equation. Solution of the vector differential equation using the normal form.
- Criteria for the controllability and observability of systems. The role of system eigenvalues.
- Examination of system stability using the Lyapunov method. Detectable and stabilizable systems.
- Placement of closed loop poles. Observer design when feedback of all state variables is not possible.
- Formulation and solution of Riccatti equations. Linear Quadratic Regulator (LQR) και Kalman filter methodologies.
- Discrete time systems – Representation of signals on the PC. Discretization of dynamic continuous systems. Stability, controllability, observability, optimal control in dynamic discrete-time systems.
- Controller design based on Model Predictive Control (MPC). Dynamic Matrix Control (DMC).

Hours per semester:

| LECTURES | 27 | EXERCISES | - | LABORA-TORY | 38 | HOME-WORK | 110 | **TOTAL HOURS: 175** |
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Student performance/ evaluation:

The evaluation of the students will be done through:

- A Final (written) Examination (FE), including solving exercises using books and notes
- A Computational Exercise in Matlab/Simulink (CE) in groups of 3-4 students (is taken into consideration only if it contributes positively),
- A Series of Exercises (SE) in groups of 3-4 students based on computational laboratories in the PC-Lab (is taken into consideration only if it contributes positively),
- Laboratory exercises (LE) in groups of 3-4 students, taking into consideration the overall presence and execution of the exercise, personal answers and group report.

**The Final Grade results as follows:**

**Final Grade = max [FE, 0.6 x (FE) + 0.2 x (CE) + 0.1 x (SE) + 0.1 x (LE)]**