Technical University of Crete

School of Electrical & Computer Engineering

Courses & research topics offered to the incoming Erasmus+ students during the Academic Year 2018-19

A. Postgraduate courses

A.1 Autumn Semester:

Postgraduate courses are not offered to the incoming Erasmus+ students during the Autumn Semester of the Academic Year 2018-19.

A.2 Spring Semester:

1) **Parallel and Distributed Computer Architecture - ACE 605 / 7 ECTS units:** Introduction to parallel computer architectures: execution models and the Flynn taxonomy, SIMD and MIMD architectures, shared memory and message passing systems, computer networks. Shared memory architectures and cache coherence, memory consistency models. Networks, clusters of workstations and grid computers as parallel computers. Parallel computer architecture performance evaluation and benchmarks, parallel and distributed software development issues, programming models for parallel computers. Input/Output (I/O) systems for parallel computers.

2) **Special Topics in the Design of Analog CMOS Integrated Circuits - ACE 604 (Assoc. Prof. M. Bucher) / 7 ECTS units:** Introduction to the design of low-voltage (LV), low-power (LP), radio-frequency (RF) analog CMOS integrated circuits (ICs). Introduction to nanometer-scale CMOS technology. The scaling of CMOS technology according to Moore's law. Single- and multi-gate CMOS technology, SOI technology, FinFET technology. Introduction to foundry Process Design Kits (PDKs) and compact models (EKV3, BSIM6). Charge-based description of MOS Transistor (MOST) operation for LV-LP-RF CMOS IC design. The operation of MOSTs in weak, moderate, and strong inversion. Efficient charge- and current-based description of MOST operation, from static to dynamic, high-frequency operation, noise, and statistical variability. Process variations, local mismatch. Design and simulation tools for analog/RF IC design. Design examples of Operational Transconductance Amplifiers (OTAs), Low Noise Amplifiers (LNAs).

3) **Electronic Energy Management Systems - ENE 602 (Assoc. Prof. E. Koutroulis) / 7 ECTS units:** Design of DC-DC and DC-AC power converters. Battery structures for electric energy storage. Electronic systems for maximizing power production (Maximum Power Point Tracking – MPPT). Smart meters. Special sensors, actuators and controllers for

energy management and energy saving in Smart Homes/Buildings. Electronic energy management systems for Renewable Energy Sources, Smart Grids, Microgrids and electric vehicles. Electronic systems for wireless power transmission and energy harvesting.

4) **Decision Making and Learning in Multiagent Environments - CS 601 (Assoc. Prof. G. Chalkiadakis) / 7 ECTS units:** Utility Theory, Decision Theory and Game Theory (cooperative and non-cooperative). Rationality and strategic decision making. Reinforcement Learning and Multiagent Reinforcement Learning. Unsupervised Learning and Probabilistic Topic Modeling. Deep Learning and Deep Reinforcement Learning. Learning in game-theoretic environments.

5) **Introduction to the Quantum Technology – PHYS 602 (Assoc. Prof. D. Angelakis) / 7 ECTS units:** Introduction to Quantum Mechanics and the basics of quantum computation and cryptography. Dirac notation, linear quantum operators and observables, Hilbert space. Quantum mechanics postulates: quantum states, time evolution and Schrödinger equation, quantum measurements. Quantum bits and Bloch sphere. Quantum gate for one and two qubits. Entanglement. Quantum circuits and applications: superdense coding and quantum teleportation. Quantum computing and quantum parallelism. Quantum algorithms: Deutch, Deutch-Jozsa. The quantum Fourier transform. Grover's algorithm for search. Basics of quantum cryptography: the Ekert91 and BB84 protocols. Quantum implementation technologies review. The De Vincenzo criteria. The spin-qubit, Rabi oscillation and single qubit gates. Two qubit gates with spin qubits. Summary of the basics of quantum technologies based on linear optics, cold ions, Cavity QED systems, NMR, solid state and superconducting circuits.

B. Supervision of diploma thesis (for undergraduate students) and MSc/PhD thesis (for postgraduate students) during the Autumn and Spring Semesters, in the following fields:

1) Computer Architecture, data-center processing, parallel programming, FPGA Design. **(Prof. D. Pnevmatikatos)**

2) Multiagent Systems (including Multiagent Learning), (Algorithmic) Game Theory, Computational Social Choice, Smart Grid. **(Assoc. Prof. G. Chalkiadakis)**

3) Power Electronics, Microelectronic Energy Management Systems, Renewable Energy Sources, Sensors & Electronic Measurement Systems. **(Assoc. Prof. E. Koutroulis)**

4) Quantum Information Algorithms. **(Prof. D. Ellinas)**

5) Implementation of Quantum Computation with cavity QED or Superconducting Circuits or Integrated Photonic Chips, Different projects in implementation of Quantum

Simulations and Quantum Computing in Quantum Technologies. **(Assoc. Prof. D. Angelakis)**

6) Design of analog integrated circuits for low-power, low-voltage, low-noise analog/RF applications. Variation-aware, reliability-aware integrated circuit design. Semiconductor device physics, advanced nanoscale CMOS technology. Power semiconductor devices and applications. Analysis, characterization, and compact modeling of active and passive elements at low and high frequencies. Development of Computer Aided Design (CAD) tools. **(Assoc. Prof. M. Bucher)**

7) Electrophysiological signal analysis, Biomedical image processing, Biomolecular Imaging, Genomic data analysis and interactions, Image processing for surveillance applications. **(Prof. M. Zervakis)**