Génie Electrique et Electronique

SEL Study Project Information (Fall 2022)
Information on Semester Projects and List of Projects

https://sti.epfl.ch/research/institutes/iem/master-and-semester-projects-sel/
Steps to Register for a Semester Project

1. Find a master/semester project
   • Visit the web pages of the IEM laboratories using the links given on the first page
   • Verify that the Professor in charge of the project is affiliated with SEL
   • For projects with other sections, submit your project to SEL for approval

2. Contact the Professor or PhD student in charge of the project
   • Discuss your project with the Professor or the associated PhD student
   • Agree on your project with the Professor

3. Registration with IS-Academia
   • Register with IS-Academia (only the registration with IS-Academia is authoritative)
   • Save and print your registration
Study projects can be carried out as
- BSc Semester projects (BA6: Projet d'électricité): 7 ECTS
- MSc Semester project (MA2/3: Project in EE): 10 ECTS

Projects start at the beginning of the semester

You are responsible to
- Register with the SAC
- Approach your advisor shortly before the start of the semester or latest in the first week of the semester to arrange for a kick-off meeting
- Approach your advisor early in the project in case of issues

Semester project reports should be handed in before the start of the exam session, BUT extensions can be discussed with your advisor
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Electromagnetic Compatibility Laboratory (EMC)

- Lightning discharge
  - Modeling, experimental characterization, protection and nowcasting
- Time Reversal
  - Application to fault location in power networks, humanitarian demining and partial discharge localization

https://www.epfl.ch/labs/emc/education/projects/
Embedded Systems Laboratory (ESL)

- Smart embedded systems and Edge AI architectures
  - Design of wearable systems (hardware and embedded software design)
  - Architectures of accelerators for embedded systems and FPGAs
  - Embedded machine learning (ML)
- Internet of Things (IoT) systems
  - Low-power multi-processor architectures for ML inference and training
  - HEEPocrates: open-source healthcare energy-efficient platform – IC Design
  - Medical wearables devices

https://www.epfl.ch/labs/esl/studentprojects/
Embedded Systems Laboratory (ESL)

- **Sustainable cloud computing**
  - Cooling-aware design of many-core servers and racks
  - Data center scheduling algorithms with renewables energy sources
  - Embedded machine learning

- **Sustainable Deep Learning (DL) and Machine Learning**
  - Federated and distributed machine learning optimization
  - Low-power architectures for DL training
  - Digital Twin technologies for sustainable cities and urban environments

https://www.epfl.ch/labs/esl/studentprojects/
Integrated Neurotechnologies Lab (INL)

• Neural Interface IC Design
• Neural recording circuits
• On-chip machine learning
• Real-time symptom tracking
• Neurostimulation
• ML Algorithm Design for Neuro Applications
• Efficient On-chip Processing, Biomarker Extraction

https://www.epfl.ch/labs/inl/inl/student-projects/
• Low-Power Mixed-Signal IC Design for Sensor Interfaces
• Neural implants for psychiatric disorders
• Adaptive stimulation for Parkinson’s disease, epilepsy
• Brain-Machine Interfaces
• Energy-Efficient ML Processors
• Compressive Sensing

https://www.epfl.ch/labs/inl/inl/student-projects/
• AI/ML for graph-based data and geometric deep learning:
  • Biology: protein design, modeling of cellular processes
  • Analysis of omics data
  • Neuroscience
  • Sensors
  • …

https://lts2.epfl.ch/projects/list
Signal Processing Laboratory (LTS4)

- Machine learning
  - Robust machine learning
  - Interpretable models and algorithms
- Network analysis
- AI for medicine

- Signal and image processing
  - Graph signal processing
  - Image representation and communication
  - Distributed signal processing

Prof. Pascal Frossard
http://lts4.epfl.ch
Signal Processing Lab 5 (LTS5)

- Computational medical imaging:
  - Magnetic Resonance, ultrasound imaging and digital pathology (microscopy)
  - Image reconstruction and analysis
  - Via inverse problems & Machine Learning
  - In brain imaging and in oncology

• Computer Vision:
  • Image modality conversion
  • Anomaly detection
  • Object detection, recognition and tracking
• With Machine Learning (self-supervised learning)

Microwaves and Antennas (MAG) – Prof. Skrivervik

- **Antennas**
  - Antennas for medical implants
  - Wireless propagation in biological tissues
  - Antennas for CubeSats

- **Microwaves**
  - Microwave resonators for atomic clocks
  - Design of an Amplifier in the Ka Band

- **EPFL Make projects**
  - Antennas for MAKE projects
  - Microwave components for make projects

- **Customized projects on demand**

Mixed-Signal Integrated Circuits Lab (MSIC Lab)

• Analog/Mixed Signal ICs
  – with SPICE and Cadence
• Compact mixed-signal circuits
  • Circuits for in-memory computing
  • Circuits for high-speed communication interface
• AMS system on PCB
  – with Altium, Python and lab work
• Infraboard ecosystem
  • Digitally controlled references
  • pW power measurement

https://www.epfl.ch/labs/msic-lab/master-semester-internship-projects/
Mixed-Signal Integrated Circuits Lab (MSIC Lab)

• **Ultra-Low-Power Systems**
  – with Circuit / FPGA / PCB / Lab work / C+Linux

• Circuits: Ultra-low-power sensor/actuator interface circuits

• FPGA: PC to various peripheral interface translation

• System + PCB: Modular ULP component integration and programming

[https://www.epfl.ch/labs/msic-lab/master-semester-internship-projects/](https://www.epfl.ch/labs/msic-lab/master-semester-internship-projects/)
Power Electronics Laboratory (PEL)

- Power Electronics Conversion
- Modeling
- Simulations
  - Offline (MATLAB, PLECS)
  - Real-Time HIL
- FEM, CFD
- Design optimization
- Digital control (TI DSP)

Power Electronics Laboratory (PEL)

- Power Electronics Converters
  - Design optimization
  - Power semiconductors
  - Magnetic devices
  - Thermal management
  - Integration
  - Prototyping
  - Experimental validation

Photonic Systems Laboratory (PHOSL)

- Integrated linear and nonlinear photonic
  - Design and simulations of optical waveguides and microresonators - comsol, lumerical, matlab
  - Experimental characterization of integrated optical devices—coupling, losses, dispersion, quality factor etc
  - Experimental characterization of nonlinear behavior – high power behavior

https://www.epfl.ch/labs/phosl/teaching/
Photonic Systems Laboratory (PHOSL)

• Light generation in waveguides
  • Specialty optical fibers
  • Fiber laser architectures
  • Nonlinear frequency conversion
  • Supercontinuum generation

• Light manipulation
  • Modulation of light by electro optic effect
  • Light shaping in and outside optical cavities

https://www.epfl.ch/labs/phosl/teaching/
Telecommunications Circuits Lab (TCL)

- FPGA Design in VHDL/Verilog
- Digital integrated circuits
- Design in VHDL/Verilog
- Architectures for DSP
- Computer/SoC architectures
- Full Custom Digital Design
- Embedded memories
- Low-power logic design

https://www.epfl.ch/labs/tcl/page-87315-en-html/
Telecommunications Circuits Lab (TCL)

- Communication systems
  - High-performance and low-power communications
- System design & optimization
- Receiver algorithms
- Prototyping & experiments
- Wireless sensing with ML/AI
  - Localization, environmental & vital signs sensing

https://www.epfl.ch/labs/tcl/page-87315-en-html/
DESL - EPFLoop

Operation of the infrastructure
• Control of vacuum system
• Real time data acquisition
• Sensors integration

Pod Design and optimisation
• Battery design
• Low Voltage design (sensors)
• Pod Avionics

https://epfloop.ch
Linear induction motor
• Design and optimisation using analytical model
• Design and validation using 2D and 3D Finite Elements Models (FEM)

Operation and extension of the LIM test bench
• High speed measurement
• Build of new motors
• Extention of the bench to new motor types

https://epfloop.ch
Other Labs

• https://www.epfl.ch/labs/bnms/home/students-projects/
• https://www.epfl.ch/labs/desl-pwrs/education/students-projects/
• https://www.epfl.ch/labs/react/page-55873-en-html/
• https://www.epfl.ch/labs/idiap/open-positions/student-projects/
• https://www.epfl.ch/labs/lions/student-projects/