

FAME	ENSEA	
	French Language and Culture	
US Credits : 3	Lecture : 46 h	Language : English and French

Summary

This course allows the students to learn the French language and also the culture linked to it.

Prerequisites

No prerequisites

Contents

- Practice in the French language to gain a certain level of competency (grammar and vocabulary)
- France today in its socio-cultural-economic context (politics, cultural events, economics...)
- France from the past to nowadays (history, painting, wines and cheeses
- Business in France

Organization

- Duration: 34 h for French Language + 12 h for French Culture
- Quizzes, exercises and presentation (50%) and final exam (50%)
- Optional conversation workshops are offered (1h during lunch time every week)

Textbook

Français.com beginners (CLE INTERNATIONAL)

Similar to the following courses

GENERAL EDUCATION
HUMANITIES

FAME	ENSEA	
	Advanced French Language and Culture	
US Credits : 3	Lecture : 44 h	Language : English and French

Summary

This course allows the students to learn the French language and to fit in French business situations. The goal is to reach autonomy (C1-C2 level)

Prerequisites

B1+. B2 (CECR)

Contents

- Practice in the French language to improve student's competency (grammar and vocabulary)
- France today in its socio-cultural-economic context (politics, cultural events, economics...)
- France from the past to nowadays (history, painting, wines and cheeses
- Business in France

Organization

- Duration: 32 h for French Language + 12 h for French Culture
- A test will be given prior to arrival to determine the student's eligibility to the course
- Quizzes, exercises and presentation (50%) and final exam (50%)
- Optional conversation workshops are offered (1h during lunch time every week)

Textbook

Grammaire des Premiers Temps vol.2 (PUG)

Similar to the following courses

GENERAL EDUCATION
HUMANITIES

FAME	ENSEA	
	Electronic Circuits & Laboratory	
US Credits : 3+3	Lecture : 45h ; Laboratory : 44h	Language : English

Summary

Analysis of integrated amplifiers with bipolar junction transistors and field-effect transistors. Transistors linear equivalent models at high frequencies. Frequency response of transistor amplifiers. Feedback configurations, stability and compensation. Analog integrated circuits: differential-pair, current source, active load, operational amplifier.

To reinforce concepts, laboratory experiments involve work with real components on didactic circuits and PSpice simulations.

Prerequisites

- DC and AC circuit analysis.
- Bipolar and field-effect transistor operating principles, basic biasing techniques.
- Small signal analysis of single-stage transistor amplifiers.

Contents

Course objectives: After completing this course, the student should be able to do the following:

- Determine the frequency response (low, mid, high) of a single and multi-stage transistor amplifier mathematically (transfer function) and graphically (Bode plots).
- Design an amplifier circuit with required frequency response.
- Determine the gain, input and output resistances, bandwidth of a feedback amplifier circuit.
- Identify and analyse the different stages of an operational amplifier.

Topics:

- Low frequency response of single-stage transistor amplifier.
- Design of the coupling and bypass capacitors.
- BJT and FET equivalent models at high frequencies.
- High frequency response of single stage transistor amplifier.
- Cascode configuration, comparison of common-emitter and cascode frequency response.
- Feedback topologies. Properties of negative feedback.
- Stability study using Bode magnitude and phase plots. Frequency compensation.
- Basic microelectronic circuits: differential pairs, current sources, active loads.
- Analysis of the different stages of an operational amplifier.
- Operational amplifier characteristics and operating principles.

Laboratory topics:

- Characteristics and biasing of a BJT, BJT single-stage amplifiers. BJT two-stage amplifier
- FET amplifier, automatic gain control
- Multiple-stage amplifier design. Constant current source. Bipolar differential amplifier
- Amplifiers with negative feedback .Operational amplifier characteristics. Applications of operational amplifiers

Organization

- One 3-hour session of lecture per week during 15 weeks. The group of students is small enough to intertwine formal lecturing and exercises. The marking will be based on written tests and homework.
- One 4-hour session of laboratory experiments per week during 11 weeks. The marking will be based on preparations, work during the sessions and lab reports.

Textbook

1. A. Sedra and K. Smith, Microelectronic Circuits, Oxford University Press, 7th Edition

Similar to the following courses

- | | |
|--|---|
| <ul style="list-style-type: none"> • IIT Chicago ECE 312 • University at Buffalo EE 311&353 • Univ. of Pittsburgh ECE 1286&1212 | <ul style="list-style-type: none"> • University of Illinois at U-C ECE 342&343 • Mississippi State University ECE 3434 • University of Michigan at AA EECS 311 (4 cr) • Michigan Tech EE 3131 |
|--|---|

FAME	ENSEA	
	Computer Architecture: Introduction to Microprocessors and Embedded systems	
US Credits : 3	Lecture : 17h ; Laboratory : 28h	Language : English

Summary

The goals of this course are to understand the main principles of a microprocessor system. It's both based on basic courses about microprocessor and laboratory works on a real embedded system.

Prerequisites

- Digital Electronics.
- C or C++ language.

Contents

This is a lab-oriented course in which classroom topics are explored through in-depth experiments in laboratory projects.

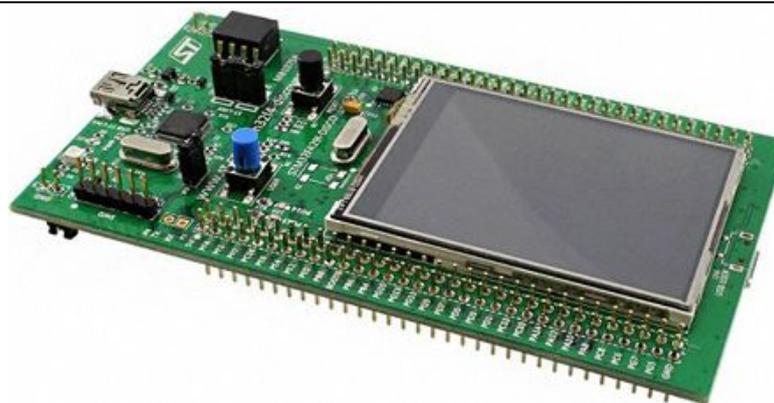
First, the students work on a simulator with a simplified model of a microprocessor. Here, basic concepts are described: data representation, arithmetic and logic unit, RISC

principles, pipelining, memory types, assembly language.

Then students have to program a Cortex M4 microcontroller (ARM) based board in assembly language and C. Thanks to this work they discover more advanced topics such as: procedure, compiler, linker, the relation between assembly code and high-level language...

Then students program their own board with a personal project with switches, LEDs, a LCD screen and other peripherals. This is a way to introduce other concepts: I/O, peripheral devices, interrupts.

Courses and laboratory works are mixed. At the beginning, there are mostly courses then at the end mostly laboratory sessions.



Topics:

- Basic microprocessor principles: fetch, decode and execute cycle + pipeline, memory.
- Machine code, assembly language, assembler, number system.
- From C to assembly language: compiler.
- Exception handling and interrupts.
- Microcontroller and embedded systems.

Organization

One 3-hour session per week for 15 weeks. The group of students is small enough to intertwine formal lecturing, exercises and laboratory. The grading is based on written tests and homework.

Textbook

Similar to the following courses

- | | |
|---|--|
| <ul style="list-style-type: none"> • IIT Chicago CS 470 • University at Buffalo CSE 341 • University of Pittsburgh CS 0447 | <ul style="list-style-type: none"> • University of Illinois at U-C CS 231 & 232 • Mississippi State University ECE 3724/ECE 4713 • University of Michigan at AA EECS 300 level • Michigan Tech |
|---|--|

FAME	ENSEA	
	Probability and Statistics	
US Credits : 3	Lecture; Tutorials : 45h	Language : English

Summary

This course allows students to understand the basis principles in Probability and Statistics. The first three chapters cover basics of probability and introduce many fundamentals that are later necessary in statistical inference studies. Chapter 4 define the mathematical expectation. Chapters 5 and 6 introduce some discrete and continuous distributions. Chapter 5, 6 and 7 represent the central core of statistical inference, estimation (point and interval) and hypothesis testing. A major feature of these chapters is the division into methods of finding appropriate statistical techniques and methods of evaluating these techniques. Chapter 8 treats the theory of linear regression; the major purpose of regression is to explore the dependence of one variable on others.

Prerequisites

- Calculus and analytical geometry (including vector analysis)
- Usual functions. Euclidian space. Partial differentiation. Multiple integrals. Line and surface integrals. Integral theorems of vector calculus

Contents

- Elementary Probability Theory including discrete and continuous distributions:
 - Discrete Uniform Distribution, Hyper geometric Distribution, Binomial Distribution, Poisson Distribution.
 - Continuous Uniform Distribution, Exponential Distribution, Normal Distribution
- Multiple Random Variables.
- Properties of a Random Sample:
 - Strong Law of Large Numbers.
 - Central Limit Theorem.
 - Slutsky's Theorem.
- Estimation: the Likelihood Principle, Maximum Likelihood Estimators, Methods of Evaluating Estimators.
- Confidence intervals: Methods of finding interval estimators, Methods of evaluating interval estimators.
- Hypothesis Testing: Methods of finding tests, Methods of evaluating tests.
- Simple Linear Regression.
- Applications.

Organization

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Textbook

Walpole, Meyers, Meyers, Ye, *Probability and Statistics for Engineers and Scientists*, 9th ed., Prentice Hall

Similar to the following courses

- IIT Chicago MATH 374/ 474/ 475
- University at Buffalo STA 301 & 302
- University of Pittsburgh ENGR 20
- University of Illinois at Urbana-Champaign
- Mississippi State University IE 4613
- University of Michigan at AA STAT 412
- Michigan Tech MA 4760

FAME	ENSEA	
	Fundamentals of Power Engineering	
US Credits : 4	Lecture : 33h, Laboratory : 12h	Language : English

Summary

The goal of this course is to understand and to apply the basic principles involved in the design and the modelling of Power Engineering systems.

Prerequisites

- Mathematics basis including integrals, differential equations, complex numbers and matrices.
- Physics basis in Electronics (e.g. voltage, current, resistance, inductance and capacitance). Students are also supposed to have basic knowledge about electronic circuit analysis.

Contents

Lecture

- Power definitions: active and reactive power, power factor, linear and non-linear receptors.
- Magnetic circuits and coils: magnetic materials, magneto-motive force, reluctance, magnetic energy, self and mutual inductances, hysteresis and Eddy current losses, equivalent circuits.
- Three-phase systems: definitions, coupling, power measurement.
- Single and three-phase transformers: Kapp assumptions, equivalent circuits, losses and efficiency, parameter identification using no load test and short-circuit test.
- DC motors: Structure and model, operating modes and power (motor, generator), efficiency.
- Three-phase AC motors: Structures, models, equivalent circuits, power losses and efficiency.
- Power electronics: Elementary components (Diode, IGBT, FET) and design rules (association of voltage and current sources), power bridges (rectifier, chopper, inverter) and introduction to variable speed drives,
- Brief introduction to power networks and smart grid.

Labs

- Transformer (hysteresis cycle and magnetic saturation, no load test and short-circuit test, operation under resistive, inductive and capacitive load).
- Variable speed drive based on a DC motor and a controlled power bridge.
- Alternator (synchronous generator) and power generation.

Organization

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Textbook

Electrical Energy an Introduction, Mohamed A. El-Sharkawi, CRC, **3rd Edition**

Similar to the following courses

- | | |
|--|--|
| <ul style="list-style-type: none"> • IIT Chicago ECE 319 • University at Buffalo EE 425 • University of Pittsburgh ECE 1771 | <ul style="list-style-type: none"> • University of Illinois at U-C ECE 330 • Mississippi State University ECE 3414/3614 • University of Michigan at AA EECS 419 • Michigan Tech EE 4219 (2 cr) |
|--|--|

FAME	ENSEA	
	Signals and Systems	
US Credits : 3	Lecture : 30h ; Tutorials : 15h	Language : English

Summary

The goals of this course are to understand the main characteristics about continuous and discrete time signals and the basis needed for their further processing (filtering for example).

Prerequisites

Students are supposed to have knowledge about circuit analysis with sinusoidal signals and some ideas about Fourier series representation of periodical signals. They must of course know how to calculate basic integrals (mainly exponential functions and rectangular window) and finite and infinite geometrical series.

Contents

Continuous time signals

- Fourier and Laplace transforms
- Time invariant linear systems and convolution
- Transfer functions, stability, frequency response, Bode representation, poles / zeros diagrams
- Application to physical systems (electrical, mechanical)

Discrete time signals

- Sampling theorem. Fourier equivalence of sampled signals and sequences. Practical sampling and converters. Problem of practical reconstruction (blocker effects).
- Linear systems, time invariant and non time invariant (i.e. compressor and oversampler)
- Fourier and Z transforms
- Convolution, transfer functions, stability, frequency response, poles / zero diagrams
- Convolution / product duality. Windowing.
- Frequency sampling : Discrete Fourier Transform and applications
- Introduction to filter design.

Organization

- Approximately 40 % on continuous time signals, 60 % on discrete time signals
- Approximately 2/3 of the time will be used for formal lecturing, the remaining third being in form of tutorials (tutorial and lecture will be intertwined, as the group will be small enough to do it in the same place).

Textbook

1. B. P. Lathi, Linear Systems and Signals, Oxford Univ. Press, 2nd edition

Similar to the following courses

- IIT Chicago ECE 308
- University at Buffalo EE 303
- University of Pittsburgh ECE 1552
- University of Illinois at Urbana-Champaign ECE 310
- Mississippi State University ECE 3443
- University of Michigan at AA EECS 351 or EECS 216
- Michigan Tech EE 3160

FAME	ENSEA	
	Communications Systems	
US Credits : 3	Lecture : 33h, Laboratory 12h	Language : English

Summary

This course introduces analog and digital techniques for signal transmission. By the end of the course students should be able to analyze basic communication systems and specify their performances.

Prerequisites

- Fourier analysis of signals and systems
- Probability and random variables

Contents

Signals and Systems review

- Fourier series and transforms
- Linear systems theory, impulse response and transfer functions

Continuous waveform modulation systems

- Amplitude modulation: study of AM signal in time and frequency domains, AM modulator and demodulator circuits
- Angle modulation: study of FM signal in time and frequency domains, FM modulator and demodulator circuits
- Noise effects in analog modulations

Probability, random variables and stochastic processes

- Statistical averages, mean, correlation and covariance functions
- Transmission of a random process through a linear filter, power spectral density
- Gaussian process, white Gaussian noise

Digital communication systems

- Baseband transmission of digital signals: representation of digital information, M-ary symbols, intersymbol interference, matched filter detection, eye pattern, probability of error due to noise
- Band-pass transmission of digital signals: QAM, PSK and FSK modulations

Organization

- Include 12h of laboratory (8h of measurements on real circuits with oscilloscope and spectrum analyzer, 4h of simulations of digital systems with Matlab Simulink)
- Computer projects using MATLAB software as homeworks

Textbook

Simon Haykin & Michael Moher, Communication Systems, John Wiley, 5th Edition

Similar to the following courses

- IIT Chicago
- University at Buffalo EE 483
- University of Pittsburgh ECE 1472
- University of Illinois at Urbana-Champaign
- Mississippi State University
- University of Michigan at AA EECS 400 level
- Michigan Tech EE 3250

FAME	ENSEA	
	Algorithms design and analysis	
US Credits : 3	Lecture; Tutorials : 45h	Language : English

Summary

This course covers basic techniques of design and analysis of efficient algorithms for standard computational problems.

Prerequisites

Contents

A broad range of the most commonly used algorithms will be detailed. Some examples include algorithms for sorting, searching, encryption, compression and local search. The students will implement and test several algorithms:

- Recursion
- Dynamic programming
- Greedy algorithms
- Divide-and-conquer
- Dynamic Data Structures
- Fundamental graph algorithms

Organization

Textbook

T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, Introduction to Algorithms, The MIT Press, 3rd edition (July 31, 2009)

Similar to the following courses

- IIT Chicago CS 430
- University at Buffalo CSE 331
- University of Pittsburgh CS 1501
- University of Illinois at Urbana-Champaign CS 473
- Mississippi State University CSE 2383 / CSE 4833
- University of Michigan at AA
- Michigan Tech CS 4321

FAME	ENSEA	
	Operating Systems	
US Credits : 3	Lecture; Tutorials : 45h	Language : English

Summary

The purpose of this course is to understand and use the basic concepts of operating systems.

Prerequisites

- C programming language

Contents

The basic concepts of operating systems are common to most computer systems, and enable the interfaces between the computer and the programmer. The Linux kernel will be taken as example to analyze common mechanisms. Concepts listed below will be discussed:

- process management, process data structures, scheduling
- memory management, virtual memory
- inter-process communication, signal, shared memory, semaphores, message queues
- Threads, condition variables
- kernel initialization, kernel modules programming

Laboratory project:

- Development of a micro shell: display of output codes and execution times of programs launched, concatenation of commands, redirection of inputs and outputs to files
- Memory allocator: rewrites malloc() and free() functions so that data integrity is checked each time the allocated area is freed.
- Interprocess communications: error-free communication of 3 processes using pipes, signals and shared memories.
- Threads: error-free synchronization between multiple threads.

Organization

- Approximately 1/3 of the time will be used for formal lecturing, the remaining third being in form of tutorials (tutorial and lecture will be intertwined, as the group will be small enough to do it in the same place).
- The final mark will be composed at 1/3 by a written exam, and at 2/3 by the work done in practical work.

Textbook

1. D. P. Bovet, M. Cesati, Understanding the Linux Kernel, O'Reilly Media (October 2000)
2. A.S. Tanenbaum, Modern Operating Systems, Prentice Hall, 3 edition (December 21, 2007)

Similar to the following courses

- IIT Chicago CS 450
- University at Buffalo CSE 421
- University of Pittsburgh CS 1550
- University of Illinois at Urbana-Champaign CS 423
- Mississippi State University CSE 4733
- University of Michigan at AA EECS 300 level
- Michigan Tech

Semester S8	ENSEA	New !
	Microelectronics	
US Credits : 3	Lecture : 36h, Laboratory 28h	Language : English

Summary

This course introduces the technological processes involved to produce integrated circuits. In the context of MOS or mixed MOS & bipolar transistor high performance, or FPGA targets, the design of analog and digital circuits is revisited. A rigorous method is presented to meet design goals (algorithms, performances, environment, and constraints) and achieve a physical realization.

Prerequisites

- Validation of analog and digital electronics courses.
- Basic knowledge about bipolar and MOS transistors.

Contents

- Presentation of technological processes for IC, introduction to nanotechnologies
- **Workshop in a clean room**, prototyping and characterization of a basic IC
- MOS Transistor, CMOS technology
- Introduction to design methods (full custom, semi-custom, prediffused). Design-flow
- Topology for integrated analog circuits : Op Amps, OTA. Design of state variables filters : gm-C and switched-capacitors approach. Translinear amplifiers, Gilbert multipliers.
- Initiation to Computer Aided Design in industrial environment: Cadence and its tools
- Full custom CAD of a simple analog function
- Innovative architectures : systems on chip

Laboratory project

- SOC programming

Textbook

Similar to the following courses

- IIT Chicago
- University at Buffalo
- University of Pittsburgh
- University of Illinois at Urbana-Champaign
- Mississippi State University
- University of Michigan at AA
- Michigan Tech

Semester S8	ENSEA	New !
	UAVs / Drones	
US Credits : 3	Lecture : 36h, Laboratory 28h	Language: English

Summary

This course is an introduction to the design, realization, instrumentation and remote control of drones. These techniques could be generalized to other autonomous mechatronics systems.

Prerequisites

- Classical mechanics: Newton's law, concepts of kinetic energy, angular momentum, inertia...
- Control systems: modeling of dynamic systems, control system analysis and design, PID design
- Microcontroller programming and interfacing: C language, ADC, timers, PWM generation, interrupts

Contents

- Notions of mechanics
- Aerodynamics
- Motorization
- Sensor specifications (accelerometer, gyroscope, magnetometer, GPS...)
- Sensor data fusion (Complementary or Kalman filter)
- Control (PID, multivariable)
- Microcontroller (STM32 family)

Laboratory project

- Testing a pre-built quadcopter drone
- Acquisition (I2C/SPI protocols) and processing of sensors data (accelerometer, gyroscope, magnetometer...)
- Generation of PMW control signals for motors
- Dynamic modeling and simulation with Matlab/Simulink
- Feedback and PID control

Textbook

Fundamentals of Inertial Navigation, Satellite-based Positioning and their Integration, A. Noureldin, T. Karamat, J. Georgy, **SPRINGER**

Similar to the following courses

- IIT Chicago
- University at Buffalo
- University of Pittsburgh
- University of Illinois at Urbana-Champaign
- Mississippi State University
- University of Michigan at AA
- Michigan Tech

Semester S8	ENSEA	New !
	Internet of Things	
US Credits : 3	Lecture: 36h, Laboratory 28h	Language: English

Summary

IoT networks interconnect embedded physical objects such as distributed control systems used in autonomous vehicles and sensor networks used in structural health monitoring and smart cities. According to predictions, IoT will account for 45% of all Internet traffic by 2020, showcasing the importance of IoT applications.

This module focuses on the architectures and protocols of IoT communication networks; we will study cases such as wireless sensor networks and vehicular IoT networks (V2V, V2X, X2V to assist driving). The option covers a wide range of topics, starting from the physical layer (PHY), and moving to IoT MAC and network layers (802.15.4, 6LoWPAN, ZigBee, etc.). Special topics, including IoT security protocols – IPSec, DTLS, etc., will also be covered. Students will have the chance to get introduced to the realm of IoT and experiment with intelligent, interconnected objects, they can potentially conceptualize, design and develop in the future as engineers.

Prerequisites

- Digital communications
- Networking fundamentals

Contents

- Communication networks for IoT
- Fundamental trade-offs between rate, connectivity, latency
- Wireless sensor networks
- Energy consumption, energy harvesting
- IoT PHY: NB-IoT
- Networking for IoT, TCP-IP, IPv6, 6LoWPAN, ROLL/RPL
- IoT Protocols, 802.15.4, ZigBee, RIOT, CoAP
- IoT Security, DTLS, IPSec
- Automotive IoT, V2V, V2X, X2V

Laboratory topics:

Laboratory sessions include MatLab® based experiments, experimentation with real IoT devices and remote access experimentation using the IoT FIT Lab at INRIA Saclay <https://www.iot-lab.info/>.

Textbook

- Moodle online resources

Similar to the following courses

- IIT Chicago
- University at Buffalo
- University of Pittsburgh
- Mississippi State University
- University of Michigan at AA
- Michigan Tech

Semester S8	ENSEA	New !
	Image and Virtual Reality	
US Credits : 3	Lecture : 36h, Laboratory 28h	Language : English

Summary

This course introduces digital signal processing for images, computer vision, virtual and augmented reality. After formal lecturing on these concepts, students will develop a project in teams of two students.

Prerequisites

- Imperative programming (C language)
- Object oriented programming (JAVA)
- Algorithms design

Contents

- Image generation, camera types
- Image processing, linear filtering
- Mathematical morphology, pattern recognition (Hough transform), segmentation
- Computer vision: camera calibration, stereovision, structured light
- Virtual reality: VR helmets technology, 3D modeller, 3D engine
- Augmented reality: effects insertion, image synthesis

Textbooks

- Digital Image Processing, Gonzales & Woods, 3rd edition, Pearson
- Unity 5.x Game Development Blueprints, John P. Doran, 2016, PACKT
- Game Engine Architecture, Jason Gregory, 2014, CRC press

Similar to the following courses

- IIT Chicago
- University at Buffalo
- University of Pittsburgh
- University of Illinois at Urbana-Champaign
- Mississippi State University
- University of Michigan at AA
- Michigan Tech

Semester S8	ENSEA	New !
	Artificial Intelligence and Big Data	
US Credits : 3	Lecture : 36h, Laboratory 28h	Language : English

Summary

This course is an introduction to artificial intelligence and its application to the processing of big quantities of data. Classification and prediction questions will be studied through different AI methods in order to find solutions for automatic image indexation or for recommendation systems.

Prerequisites

- Programming skills (Python language)
- Linear Algebra
- Basic Probability and Statistics

Contents

- Data mining, introduction to data bases
- Statistical learning, linear classifier, neuron networks, decision trees
- Introduction to deep learning
- Visual recognition, image interpretation
- Recommendation systems, user profile generation

Textbook

- Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016, <http://www.deeplearningbook.org>
- Pattern Recognition and Machine Learning, Christopher Bishop, Information Science and Statistics, 2006

Similar to the following courses

- IIT Chicago
- University at Buffalo
- University of Pittsburgh
- University of Illinois at Urbana-Champaign
- Mississippi State University
- University of Michigan at AA
- Michigan Tech