Sensor, Signal & Information Processing (SenSIP) Center

Ira A. Fulton School of Engineering, Arizona State University

D R A FT

GRADUATE TRAINING CERTIFICATE

INDUSTRY GRADUATE TRAINING

Sensor Signal and Information Processing

ARIZONA STATE UNIVERSITY

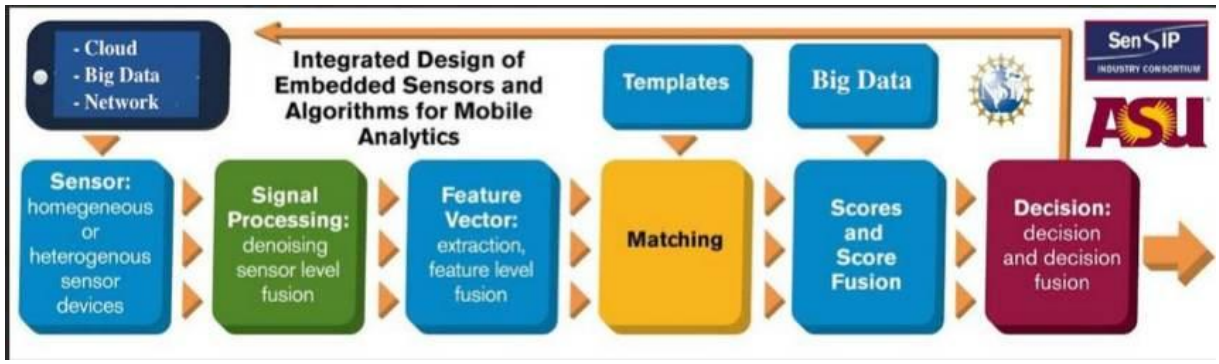
GRADUATE EDUCATION

The SenSIP graduate certificate is a programmatic or linked series of courses in a single field or in one that crosses disciplinary boundaries. The graduate certificate facilitates professional growth for people who already hold the baccalaureate degree, and it may be freestanding or linked to a degree program.

1. OVERVIEW

Sensors and signal processing algorithms are now embedded in billions of mobile devices and have been deployed for several applications including health, security, sustainability and integrated media. The Sensor Signal and Information Processing (SenSIP) center established this graduate certificate to support industry training and workforce creation in this area. The Sensor signal and information processing (SENSIP) graduate certificate is within the IAFSE with the goal to offer opportunities for focused study of signal processing and systems algorithms for sensor related applications. Certificate participants will be able to take all courses online i-courses through GOEE. The rationale for a professional SENSIP certificate is multifold: a) a master's degree is not needed to position an individual to work in the sensor industry, b) the certificate will enable students or professionals to have certified specialization in this area, c) the certificate will enable engineers in industry having somewhat dated degrees to retrain and position themselves to be redeployed in higher paying jobs, d) the certificate will support the creation of a specialized post-baccalaureate workforce in an area of state and national economic importance.

Additional reasons and byproducts of such a program are: a) offering an online certificate option through GOEE will bring in more students from a nationwide or even worldwide pool (GOEE has large global relations with Vietnam and SenSIP has MOUs signed with Tech de Monterrey (ITESM), University of Cyprus (UCy), Imperial College, and University of British Columbia (UBC) as part of our NSF I/UCRC research activities), b) a certificate will boost ECEE's class enrollment and SenSIP's industry engagement and it will provide additional compelling reasons for attracting I/UCRC members to support graduate research, and c) it will enable us to enrich training activities planned with our minority institution partners Prairie View A&M (PVAMU) and Florida International University in our NSF Phase 3 Education and NSF traineeship grant collaborations.



Integrated Sensors and Algorithms

A. Required and elective courses.
Please note: a minimum of 2/3 of the courses required for a graduate certificate must be at the EEE 500-level or above *on the student's iPOS*.

Required Courses			**Credit Hours**
Prefix & Number	*Course Title*	*Offered Online*	**12**
EEE509	DSP Algorithms and Software (may replace with EEE407)	Y	3
EEE 554	Random Signal Theory	Y	3
EEE 510	Multimedia Signal Processing	Y	3
EEE556	Detection and Estimation Theory	Y	3
Electives (Students choose two courses for a total of 6 credit hours.			**Credit Hours 6**
EEE 591	Topic: Communication Systems	N	4
EEE 591	Topic: Communication Networks	N	3
EEE 505	Time Frequency Signal Processing	N	3
EEE506	Digital Spectral Analysis	N	3
EEE 508	Digital Image and Video Processing and Compression	N	4
EEE 511	Artificial Neural Computation	N	3
EEE 552	Digital Communications	N	3
EEE 606	Adaptive Signal Processing	N	3
EEE 557	Broadband Networks	N	3
EEE 581	Filtering of Stochastic Processes	N	3
EEE 589	Linear Algebra and Convex Optimization	N	3
BMI 501	Introduction to Biomedical Informatics	N	3
CSE 575	Statistical Machine Learning	N	3
EEE591	Topic: Real-time DSP Systems	N	4
EEE 598	Topic: Sensor Systems; Algorithms and Applications	Y	3
BME 598	Topic: Biomedical Signal Processing	N	3
EEE 598	Topic: Theory and Algorithms for Big Data Analytics	N	3
Total credit hours			**18**

SAMPLE PLANS OF STUDY

SAMPLE 1

EEE 509	DSP Algorithms and Software	**3**	**Fall**
EEE 554	Random Signal Theory	**3**	**Fall**
EEE 606	Adaptive Signal Processing	**3**	**Spring**
EEE 510	Multimedia Signal Processing	**3**	**Fall**
EEE 556	Detection and Estimation	**3**	**Spring**
CSE 575	Statistical Machine Learning	**3**	**Spring**
	Total Credits	**18**	

Only two EEE591 courses can be in a plan of study for SENSIP as elective coursework.

SAMPLE 2

EEE 509	DSP Algorithms and Software	**3**	**Fall**
EEE 554	Random Signal Theory	**3**	**Fall**
EEE 556	Detection and Estimation Theory	**3**	**Spring**
EEE 510	Multimedia Signal Processing	**3**	**Spring**
BME 598	Biomedical Signal Processing	**3**	**Fall**
BMI 501	Introduction to Biomedical Informatics	**3**	**Spring**
	Total Credits	**18**	

[+]Only two EEE 591 courses can be in a plan of study for SENSIP as elective coursework.

EEE 509 can be replaced by EEE407

CORE COURSE DESCRIPTIONS

Core Course	Course Catalog Description	Texts and Pre-reqs
EEE 407 Digital Signal Processing (DSP)	The purpose of this course is to introduce senior students to the principles and applications of Digital Signal Processing. Topics: Difference equations, Digital Filters, FIR and IIR Digital Filter Design, impulse invariant methods, the bilinear transform, frequency-domain analysis, dft, fft, deterministic and random sequences, stationary and ergodic sequences, the mean and the autocorrelation.	Prerequisites: EEE 203 or equivalent. Texts: Oppenheim and Schafer, "Discrete-time Signal Processing", 3rd Ed, Prentice Hall, 2009
EEE 509 DSP Algorithms and Software Online only	Introduction to DSP, Use of MATLAB in DSP, Design of FIR and IIR digital filters using MATLAB, The z transform and its properties, MATLAB programming and code examples for Butterworth, Chebychev, and Elliptic Filter, Spectral Estimation using the FFT, MATLAB & J-DSP code examples of the FFT, Stationary and Ergodic Signals, The power spectrum, Adaptive Filters, Adaptive noise cancellation, speech processing applications with MATLAB, Speech and audio coding.	Prerequisites: EEE 203 or equivalent. Texts: Signal Processing, A Computer-Based Approach, Sanjit K. Mitra, 2001 3rd Edition, McGraw-Hill
EEE 510 Multimedia Signal Processing	Random signals, autocorrelation, linear prediction, inverse modeling, Pol-zero modeling, DSP review, sensory audio data, Speech and audio coding algorithms, PCM/QADPCM, sub-band/transform coding algorithms, open and close loop LPC coders, MPEG audio and video algorithms, audio sensor arrays and coding, Video and networking issues.	Prerequisites: EEE 509 or equivalent. Spanias, Painter and Atti, Audio Signal Processing and Coding, Wiley 2007.
EEE556 Detection and Estimation Theory	Monte Carlo simulations, , Neyman-Pearson theorem, Detection of deterministic and random signals in noise, bias, variance, Cramer-Rao bound, Bayesian estimation, applications including biomedicine, sensors, communications, radar, and sonar.	Prerequisites: EEE 554 or equivalent in Random Signal Theory. S. M. Kay, Fundamentals of Statistical Signal Processing, Volume 2: Detection Theory. Prentice Hall, 1998.
EEE 554 Random Signal Theory	Review of probability theory: Axioms of probability, experiments, outcomes, events, conditional probability and independence. , Continuous and discrete distribution and density functions, mean, variance, moments, characteristic functions, joint distributions, joint moments and characteristic functions, conditional distributions, Stochastic processes, white noise, Gaussian random processes, stationary processes, power spectrum, Markov chains.	Prerequisites: EEE 350 or equivalent. S. Kay, Intuitive Probability and Random Processes using MATLAB, Springer 2005.