AI, ML, Data Science:
  - Artificial Intelligence
    - Evolutionary Computing
    - Computational Optimization
    - Multi-agent systems
  - Machine Learning and Pattern Recognition
    - Face Recognition
    - Biometrics
    - Computer Vision
    - Multimedia Systems, Augmented Reality
    - Deep Learning
    - Human Computer Interface
    - Information Retrieval
    - Natural Language Processing
      - Text Mining Studies
      - Social Network Analysis/Social Computing/Computational Social Science, Text
        Mining/Web Mining/Data Mining, Dimension Reduction/Similarity Learning/Machine
        Learning

Computing:
  - High Performance Computing and Big Scientific Data Analytics (HPC & Big-Data)
    - Computational mathematics
    - Comparative Genomics, Computational Biology, Bioinformatics
    - Numerical Analysis
    - Quantum field theory
    - Genome Assembly
    - Phylogeography
    - High order numerical methods for Hamilton-Jacobi equations.
    - Sparse grid methods for high-dimensional PDEs.
    - Fast convolution methods
    - Multi-scale modeling
    - High order numerical methods
    - Weighted essentially non-oscillatory methods
    - Defect correction methods
    - Kinetic theory
    - Energy materials and phase field models
    - Molecular dynamics
    - High-performance Supercomputers
    - Computer Architecture
  - Networks and Systems
    - Computer Architecture
    - Computer Security
    - Fault Tolerance
    - Distributed Systems
    - Computer and Network Security, Networking
    - Network and Pervasive Computing; P2P Computing
    - Wireless and Mobile Systems
    - Internet of Things, Pervasive Sensing
    - Mobile Computing, and Networked Embedded Systems
    - Cyber-Physical System
    - Cognitive networks, wireless sensor networks, cyber-physical systems, wireless
      communications, digital signal processing, and information theory
2019 Engineering Graduate Research Symposium Research Categories

Computing:
- **Algorithms**
  - Graph Theory
    - Applied Topology
    - Topological Data Analysis.
  - Algorithms for the analysis of large and high dimensional data sets
  - Software engineering, Formal Methods

**Mobility, Robotics**
- **Connected Automated Vehicles**
  - Sensors and actuators
  - LIDAR, RADAR
  - Machine vision, pattern recognition
  - Sensor fusion
  - AI-based automation
  - Pathfinding
  - Fault tolerance
  - Robotics and Autonomous Vehicles
  - Reinforcement Learning, Vehicle Dynamics, and Optimal Control.
  - Smart Infrastructure, embedded sensors and transponders
- **Robotics & Control System**
  - Sensors and actuators
  - Biomimetic robotic fish
  - Embedded control systems.
  - MEMS/NEMS technologies and systems
  - Control of Nonlinear system
  - Conformal antennas, engineered materials for microwave applications, and computational electromagnetics.
  - Fiber-optic sensing/actuation devices and systems
- **Traffic and Transportation System**
  - Highway Design
  - Traffic Engineering
  - Pavement Management/Rehabilitation
  - Intelligent Transportation Systems
  - Transportation systems analysis
Electrosystems:
- **Fabrication & Circuit Design**
  - Manufacturability, reliability, analysis, and control of linear and rotating electrical machines and drives
  - Thermoelectrics, and later on a group for printing technologies
  - Film coating technologies for industrial applications.
- **Signal Processing**
  - Compressed Sensing
  - Nonlinear ultrasonics
  - Finite element modeling
- **Power Electronics**
  - Control of power electronic systems
  - Power converter topologies
- **High-frequency integrated circuits and systems**
  - Antennas, scattering, radar target identification, measurement of the electromagnetic properties of materials, electromagnetic theory.
  - Millimeter-wave Electronics, IR Sensors, Microsystems Packaging, RF-MEMS, BioMEMS, and Flex Electronics.
  - Design of analog/mixed-signal/RF circuits and systems including wireless transceivers and RF power amplifiers
  - Thin Film Solar Cells, Supercapacitors, Optical Thin Films, Functional Coatings, Electronic Materials and Semiconductor Devices
- **Computational Electrosystems**
  - Computational plasma physics, electromagnetics, beam physics, high field effects
  - Theory and modeling of nanoelectronics, electromagnetic fields and waves, plasmas, and accelerator technology Quantum kinetic theory; Transport theory; Quantum Boltzmann equation.
  - Wavelet and local spectral methods for PDEs; Computational electromagnetics; Computational fluid dynamics; Richtmyer-Meshkov instability; Structural analysis.
  - Mathematical molecular biosciences
  - Computational plasma physics
  - Theoretical & Computational Astrophysics
  - Ultra-cold atomic systems and quantum simulation
2019 Engineering Graduate Research Symposium Research Categories

**Health, Food Safety, and Biomechanics:**

- **Health**
  - Bioimaging
  - MEMS/NEMS technologies and systems, micro sensors and actuators, biomimetic devices and systems, microfluidic and lab-on-chip systems, and microsystem integration and packaging technologies
  - Characterize, modulate, and regenerate neuronal responses at the interface of electrodes implanted in the brain
  - Biomedical optics, MEMS/MOEMS, multi-modal targeted imaging, wearable and implantable medical devices, ultrafast laser applications.
  - Biomedical optics
  - Biosensors and actuators
  - Nanotechnology and diamond NEMS-biosensor solutions in biomedical diagnostics, automation of biotechnological processes, and food analysis as well as in the development of diamond high-power terahertz systems
  - Bio-imaging and medical decision-making
  - Integrated medical diagnostics
  - Tomographic image reconstruction
  - Hybrid machine learning algorithms
  - Kinetic data analysis
  - Application of AI to healthcare delivery
  - Cell plasticity and tissue remodeling in health and disease
  - Computational toxicology
  - Macroscopic and microscopic optical imaging tools and uses imaging to assess tissue responses to stress
  - Genomics and computational biology
  - Biology and the function of extracellular vesicles (EVs)
  - Mathematical molecular biosciences; Mathematical biophysics; Variational multiscale models; Ion channel transport; Proton transport; PDE modeling of biomolecular surfaces; Virus capsid modeling.
  - Nanotechnology-based strategies to harness the power of the immune system
  - Protein expression; fermentation engineering; multiphase biocatalysis; biobased products.
  - Health diagnostics
  - Health risk assessment
- **Food Safety**
  - Food processing
  - Food testing
  - Food sterilization
  - Probiotics
- **Biomechanics**
  - BioMEMS, microfluidics, biosensors, and point-of-care diagnostics [ME]
  - Biomechanics of human movement, motor learning and control, rehabilitation robotics
  - Biomaterials with bioactive and bactericidal properties for tissue healing and regeneration
  - Biomedical Informatics
  - Cardiovascular mechanics
  - Vascular growth and remodeling, mechanobiology and tissue engineering, and computational and statistical interventions for vascular disease
2019 Engineering Graduate Research Symposium Research Categories

**Mechanics, and Structures:**

- **Computational mechanics and modeling**
  - Design optimization,
  - Finite element method
  - Micro-mechanics of soft and bio-inspired materials
  - Experimental studies of thermo-fluids and reacting flows
  - Turbulent combustion physics
  - Mathematical modeling of turbulence
  - Whole-body biomechanics
  - Friction dynamics
  - Fluid mechanics and biophysics
  - Thermal-fluid science and engineering
  - Unsteady fluid mechanics and aerodynamics,
  - Turbulent flows, hydrodynamic instabilities, and compressible flows
  - Computational fluid dynamics
  - Dynamical systems; Controlling chaos ; Controlling turbulence; Controlling pattern formation.
  - Stochastic modeling and uncertainty quantification

- **Structures**
  - Composite structures,
  - Experimental mechanics, process control and optimization
  - Material issues in design and manufacturing; manufacturing processes; mechanical behavior of materials; microstructured and graded materials.
  - Biomaterials
  - Nanomanufacturing, nanomaterials, and microfabrication

- **Modeling and Analysis**
  - Multi-material joining
  - Computational design of materials and structures
  - 3D micromechanical modeling
  - Pavement response and performance modeling, dynamics of pavements and truck-pavement interaction

- **Mechanical systems**
  - Turbomachinery, centrifugal compressors, wave rotors, refrigeration and HVAC
  - Dynamic systems, noise and vibration, engines and propulsion systems, and integrated systems design and development.
  - Mechatronics and robotics.
  - Manufacturing/3D Printing using laser energy
  - Thermodynamics, combustion, optical diagnostics, turbulence, internal combustion engines
  - Fluid-structure interaction
  - Dynamics and vibration, and smart structures and energy harvesting
  - Combustion, ignition, alternative fuels, thermodynamics and internal combustion engines
  - Heat transfer; thermophysical property measurement; parameter estimation; thermal biology
Materials & Manufacturing
- Design of novel composite materials
- Plasma Sources, Plasma-Material Interactions
- Plasmas for synthesis of semiconductor nanostructures, gas-phase processing
- Plasma-assisted semiconductor materials processing
- Electronic materials, including temperature dependent electrical conductivity, Seebeck coefficient, thermal conductivity, Hall effect, and current vs. voltage measurements for materials and devices
- Mechanical deformation of metallic materials
- Composites
- Polymer synthesis techniques
- Inorganic-organic hybrid polymers
- Polymer surfaces and interfaces, molecular self-assembly, nanostructured biomimetic interfaces
- Functional thin film, coatings, adsorption, adhesion and particles
- Dynamics of lithium-ion battery and solid oxide fuel cell electrodes
- Nanoscale inorganic materials

Electrochemical engineering
- Systems biology and bioinformatics, metabolic engineering, cellular and tissue engineering
- Fiber-resin composites
- 3D printing process chemistry

Sustainability and Environment:
- Sustainable building materials
- Sustainable design
- Building material reuse
- Environmental impact of solar technologies (scarcity, toxicity and energy payback)
- End-of life management of photovoltaic wastes
- Process design and life cycle modeling of wastewater treatment
- Soil and water contamination
- Analytical method development for harmful algal toxins
- Large-scale (global to continental) water cycle modeling
- Irrigation pumping and groundwater depletion
- Water quality engineering, emphasizing protection of public health and prevention of waterborne disease.
- Water chemistry