AFRA - Africana Studies

AFRA 293-10 TOPICS IN AFRICANA STUDIES: AFRICAN AMERICAN RELIGIOUS HISTORY
Surveys the ways African culture, plantation experience, emancipation, migration, civil rights movement and urban social issues influence African American religions. Introduces black religious diversity in the US including Islam, African traditional religions, Buddhism, Humanism and New Thought.

AFRA 367-10 RELIGION AND SOCIAL JUSTICE
Many scholars/communities believe that experience affects the ways in which people conceive of and practice their faith. Explores faith/freedom from various social/cultural perspectives, examining how different groups conceive of God, faith and their own actions in struggles against oppression.

ANTH — Anthropology

ANTH 367-10 LATIN AMERICA THROUGH FILM
Explores Latin America and the Caribbean through the lens of cinema. Focuses the cultural history of the region within national, regional and global contexts, as it is depicted in twentieth and twenty-first century Latin American film making.

ARTH - Art History

ARTH 198-10 MASTERPIECES OF AFRICAN ART: BEYONCÉ & 'BLACK PRESIDENT' FELA KUTI BACK THROUGH CLEOPATRA TO PREHISTORY'S "LUCY"
Unscrambles the otherwise complex themes & histories of African art from its mysterious prehistoric rock art, through historic Ancient and Islamic art, to Contemporary art --political art, performance art, photography, film, and video art.

ARTH 238-10 ISLAMIC ARCHITECTURE FROM CAIRO TO TIMBUKTU
Architectural dialogues across the Sahara since the 9th C., focusing on the buildings of Cairo, Fez, and Timbuktu --old centers of Islamic learning. Introduces philosophical texts and travelers' memoirs in relation to buildings as congregations of space & visual imagery.

ARTH 419-10 ART & MATERIALITY IN THE IBERIAN WORLD, 1492-1800
Examines the arts in diverse regions of the Spanish & Portuguese empires in light of the raw materials employed in their production, discussing not only the techniques and properties associated with each material choice, but also the ways in which such substances were sourced & traded.

ARTH 435-10 COLONIAL AMERICAN PORTRAITURE
Introduction to current and foundational scholarship on colonial American (defined broadly) portraiture. Focusing on the production, consumption, and iconography of portraits, surveys a wide range of paintings and analyzes portraiture as both material and visual culture.

ARTH 619-10 ART & MATERIALITY IN THE IBERIAN WORLD, 1492-1800
Examines the arts in diverse regions of the Spanish and Portuguese empires in light of the raw materials employed in their production, discussing not only the techniques and properties associated with each material choice, but also the ways in which such substances were sourced and traded.

ARTH 623-10 WHAT IS A MEDIUM?
Studies whether media, as Friedrich Kittler claimed, determine our situation. Bridging disciplinary concerns of art history and media studies, considers old and new formulations of, and challenges to, the 'medium' concept, and their bearing upon our present understandings of art and visual culture.
ARTH 626-10 ART & PERFORMANCE IN THE LONG 19TH CENTURY
Art in relation to music, opera, theatre, poetry, cabaret, circus, street theatre, and early cinema. Tragedy and comedy, gender and sexuality, celebrity, artistic performance, and inter-art connections will be considered with multiple artistic mediums and primary critical texts & recent literature.

ARTH 635-10 COLONIAL AMERICAN PORTRATURE
Introduction to current and foundational scholarship on colonial American (defined broadly) portraiture. Focusing on the production, consumption, and iconography of portraits, this course surveys a wide range of paintings and analyzes portraiture as both material & visual culture.

ARTH 667-15 EXHIBITIONS & INTERPRETATION OF MATERIAL CULTURE
Practicum at Winterthur in exhibiting and interpreting American material culture and entrepreneurship, centering on objects and images selected from Winterthur and regional collections. Topics include: exhibition preparation, installation, programming, fundraising, marketing.

BHN - Behavioral Health & Nutrition

BHAN 367-10 MENTAL HEALTH AND WELL-BEING
Addresses common mental health issues and conditions. Examines stress management, self-esteem, depression, bipolar disorder, anxiety, substance abuse, and disordered eating. Considers commonly used mental health indices and and which mental health professionals to refer.

BHAN 367-11 AQUATICS MANAGEMENT
Trains recreation and athletic professionals in how to manage an aquatic facility. Provides essential skills/knowledge needed by facility managers to oversee the safe operation of an aquatic facility.

BHAN 467-10 PEER MENTOR
Develops and applies skills in Peer Mentors. Studies and applies experiences under BHAN Professional Academic Advisor supervision.

BHAN 467-11 WORKSITE WELLNESS
Explores first-hand, an orientation to worksite wellbeing and health promotion. Under the supervision of a field supervisor, provides hands-on experience and emphasis on skills needed to create healthy, happy, highly productive employees and work settings.

BMEG - Biomedical Engineering

BMEG 167-10 INTRODUCTION TO BIOMEDICAL ENGINEERING
Introduces students to the breadth of career opportunities in biomedical engineering, aseptic cell culture techniques, standard test methods, quantitative analysis, and technical communication. PREREQ: CHEM103 or 107 and BISC207.

CHEG - Chemical Engineering

CHEG 667-16 MOLECULAR MODELING AND SIMULATIONS OF SOFT MATERIALS
Basic concepts in developing/using atomistic and coarse-grained models, conducting a stochastic or deterministic simulations (Monte Carlo & molecular dynamics), and analysis methods for calculating structure and thermodynamic properties for systems containing synthetic and biologically relevant polymers.

CHEG 667-17 VACCINES AND IMMUNOENGINEERING
Apply biomolecular engineering principles to the design and assembly of vaccines and other immune engineering apps. Overview of historical vaccine development, process technologies, immunology for engineers, and literature assessments. Discuss economics, ethics, and medical impact on global human health.

CHEG 867-20 ADVANCED MOLECULAR MODELING AND SIMULATIONS OF SOFT MATERIALS
Advanced concepts in developing/using atomistic and coarse-grained models, conducting a stochastic or deterministic simulations (Monte Carlo and molecular dynamics) and analysis methods for calculating structure and thermodynamic properties for systems containing synthetic and biologically relevant polymers.
CHEG 867-21 ADVANCED VACCINES AND IMMUNOENGINEERING
Apply advanced biomolecular engineering principles to the design and assembly of vaccines and other immune engineering applications. Overview of historical vaccine development, process technologies, immunology for engineers, and literature assessments. Economics, ethics and medical impact on global human health.

CIEG - Civil & Environmental Engineering

CIEG 467-11 TEMPORARY STRUCTURES IN CONSTRUCTION
Temporary structures in construction, for example earth retaining structures, construction dewatering, tunneling supports, roadway decking, scaffolding, shoring, concrete formwork, cranes, and bridge false work. Safety and business aspects. Case studies in failures.

CIEG 467-13 FUNDAMENTALS OF BUILDING ENERGY PERFORMANCE
Understands the fundamentals of whole-building energy performance analysis using state-of-the-art 3D modeling and computational tools. Includes how building designs and energy policies affect buildings' energy consumption.

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CISC - Computer Science

CISC 467-12 VIP: CLOUD CRYPTO

CISC 467-12 VIP: CLOUD CRYPTOGRAPHY

CISC 467-13 VIP: HIGH-PERFORM COMPUTING
Learning and using directives for parallel platforms; Migrating legacy code to GPUs and co-processors using high-level parallel programming models; Parallelizing irregular algorithms on massively parallel processors; Exploring Repeatability and Reproducibility issues.

CISC 667-10 COMMUNICATIONS SKILLS FOR COMPUTER SCIENCE RESEARCHERS
Mentored experience in writing computer science research papers, proposals, and dissertations through focused writing exercises and critiques. Practice in developing and presenting elevator talks; research posters; conference and thesis defense presentations; and research interview talks.

CISC 849-10 HPC FOR SCIENTIFIC APPLICATIONS
Data is increasing exponentially as are hardware and software challenges to analyze, simulate and understand large volumes of data. Explore how to develop and migrate legacy scientific applications using parallel programming, compiler and runtime paradigms on large scale, accelerated HPC systems.

CISC 889-10 MUTI-AGENT LEARNING
Considers what actions to take when others (teammates or adversaries) are simultaneously learning to respond to us. Primary focus on multi-agent reinforcement learning (stochastic games). Discusses both traditional AI and game-theoretic approaches in the recent literature.
CISC 889-11 TPCS: ADVANCED TOPICS IN ARTIFICIAL INTELLIGENCE: NEURAL NETWORKS/DEEP LEARNING IN NLP
Covers several applications of neural networks in NLP tasks, such as sentiment analysis and event extraction. Motivates the use of neural network architectures such as CNN, RNN and attention mechanisms.

COMM — Communication

COMM 305-10 COMMUNICATION AND SOCIAL PROTEST
Explores the communication strategies, political issues and public arguments of social protest and social movements around the world. Focuses on the issue of dissent in civil society, examining strategies and tactics of leaders, supporters, and opponents of social movements.

COMM 418-10 MEDIA ETHICS & ACCOUNTABILITY
Examines the challenges, successes and failures of ethical behavior in the news media. Looks at digital, broadcast and print platforms from a historical and current perspective.

COMM 418-12 PUBLIC OPINION & COMM
Explores the dynamics of public opinion, focusing on the forces that shape citizens' opinions; the methods for measuring public opinion; and the process of public opinion formation. Historic and contemporary readings offer a broad understanding of public opinion.

COMM 618-10 MEDIA ETHICS & ACCOUNTABILITY
Examines the challenges, successes and failures of ethical behavior in the news media. Looks at digital, broadcast and print platforms from a historical and current perspective.

COMM 618-12 PUBLIC OPINION & COMM
Explores the dynamics of public opinion, focusing on the forces that shape citizens' opinions; the methods for measuring public opinion; and the process of public opinion formation. Historic and contemporary readings will offer a broad understanding of public opinion.

CPEG - Computer Engineering

CPEG 467-10 INTRODUCTION TO BLOCKCHAIN & SMART CONTRACT DEVELOPMENT
Focuses on the innovative technology of Blockchain by exploring the underlying principles of the technology, studying recent developments, and gaining hands on learning by developing Blockchain applications, both Decentralized and Permissioned, and using existing tools.

EAMC — Early American Culture

EAMC 667-12 ORAL HISTORY: METHOD AND PRACTICE
Interdisciplinary course at Winterthur Museum. Approaches the theory and method of oral history in a seminar, as well as in field work. Involves the practice of oral history using digital and analog methods for use in an academic and public setting.

EAMC 667-15 EXHIBITION AND INTERPRETATION OF MATERIAL CULTURE
Practicum at Winterthur in exhibiting & interpreting American material culture & entrepreneurship, centering on objects & images selected from Winterthur & regional collections. Includes exhibition preparation, installation, programming, fundraising, marketing.

ECON — Economics

ECON 867-10 TOPICS IN DYNAMIC MODELING

ELEG - Electrical Engineering
ELEG 467-10 VIP: GRID INTEGRATED VEHICLES
Identify electric vehicles based on their unique charging characteristics; develop open source software that can be deployed by all electric vehicle chargers; collect data and validate results using our university fleet of electric vehicles and charging stations.

ELEG 467-11 VIP: E-TEXTILES
Involves electronic material design such as functional inks for realizing conductive, resistive and capacitive elements using additive manufacturing; Electronic design of integrated textile based biosensors; Seamless integration of electronic components. http://vip.udel.edu/e-textiles.

ELEG 467-12 VIP: CLOUD CRYPTO

ELEG 467-13 VIP: HIGH-PERFORM COMPUTING
Learning and using directives for parallel platforms; Migrating legacy code to GPUs and co-processors using high-level parallel programming models; Parallelizing irregular algorithms on massively parallel processors; Exploring Repeatability and Reproducibility issues.

ELEG 467-14 VIP: ARTGINEERING
Research includes Embedded control systems, developing open source control software and hardware, studying public interaction with robotics, advancing hands on education through exhibition quality system design and development.

ELEG 467-16 VIP: DRONES

ELEG 467-17 VIP: SCOOTERSV2.0
A self-driving mobility scooter for the elderly and the infirm. Key elements are Electronic sensors, computer vision, and machine learning. To learn more, go to http://vip.udel.edu/scootterv2.

ELEG 467-18 CYBERSECURITY SCHOLARS
Cybersecurity scholars intends to train thought leaders in cybersecurity as part of a four-year program. Students will explore real-world issues in cybersecurity while working with clients and experts.

ENGL — English

ENGL 110-113 SEM: THE EXAMINED LIFE
Considers where we drawn the line between fact and fiction, when recognizing the important debate about autobiographical authorship and identity. Reflects on the students’ own lives, and produces a series of reflective compositions and formal academic essays.

ENGL 306-10 CREATIVE NON-FICTION
A detailed course description is found on the English Department web page: https://www/english.udel.edu/courses-and-advising/courses

ENGL 306-11 WRITING INSIDE THE BOX
A detailed course description is found on the English Department web page: https://www/english.udel.edu/courses-and-advising/courses

ENGL 306-12 THE BUSINESS OF CREATIVE WRITING: WRITING THAT PAYS THE RENT
A detailed course description is found on the English Department web page: https://www/english.udel.edu/courses-and-advising/courses
ENGL 306-13 SCREENWRITING
A detailed course description is found on the English Department web page: https://www.english.udel.edu/courses-and-advising/courses.

ENWC - Entomology & Wildlife Conservation

ENWC 467-13 GROWING YOUNG NATURALISTS
Teaches key concepts in curriculum development and pedagogy to create interactive and engaging teaching modules that explore insect and wildlife behavior, life history and ecology. Includes entomology and wildlife fundamentals. Students develop their own educational units.

ENWC 467-14 INSECT RESEARCH METHODS
Sampling techniques for insect survey or biodiversity studies, including field experience, research design, data preparation, analysis and interpretation for publication.

ENWC 667-14 INSECT RESEARCH METHODS
Sampling techniques for insect survey or biodiversity studies, including field experience, research design, data preparation, analysis and interpretation for publication.

GEOG — Geography

GEOG 667-11 CLIMATOLOGY READINGS
Explores background and preliminary work being done for the upcoming Intergovernmental Panel on Climate Change 6th Assessment Report.

HDFS - Human Development & Family Sciences

HDFS 667-11 HOMELESS EDUCATION POLICY
Focuses on analyzing homeless education policies in family/community settings. Historical examination of politics and policies shaping homeless discourse and intersections of class, race, gender, sexuality, language, ability, citizenship, etc. influencing student and family life with homelessness and instability are emphasized.

HDFS 667-12 FOOD POLICY FOR FAMILIES AND COMMUNITIES
Review food policy through a community lens examining how changes to the farm bill (incl. SNAP), school food (HHFKA), food deserts, childcare and feeding in early childhood CACFP and community food efforts like farmers markets, community gardens and CSA's impact well-being.

HIST — History

HIST 268-12 SEMINAR: RACISM & SOCIAL EXCLUSION, A GLOBAL HISTORY
Introduces students to the institutional practices of social exclusion practiced in much of the world in the twentieth century.

HIST 268-26 SEMINAR: FASCISM & COMMUNISM IN EUROPE
Ideologies of fascism, communism and anarchism captivated the imagination of Europeans during the 1930's because it offered radical solutions to economic, social and political troubles created by WWI and the great depression. Explore the developments that led to that polarization.

HIST 268-31 SEMINAR: DISABILITY IN THE AMERICAN EXPERIENCE
Explores understanding how the life circumstances and prospects of people with disabilities are shaped. Introduces the critical framework for how technologies reveal individual experiences with disability, notions of citizenship, gender, sexuality, identity and accessibility.
HIST 268-32 SEMINAR: AMERICAN ETHNIC IDENTITIES
Explores the meanings of “ethnicity” in the 20th-century U.S. and their connection to histories of race relations and immigration. Studies examples of ethnic artifacts and historical interpretations of their contexts and meanings, through reading, written work and development of a class website.

HIST 337-10 TOPICS IN HISTORY: AMONG THE AMERICANS
Takes the measure of contemporary American life and character and launches upon an adventure in moral imagination. Enters upon a longstanding conversation about American virtue and default, evil done and denied and the things worth saving.

HIST 337-13 TOPICS IN AMERICAN HISTORY: AMERICAN SPORTS HISTORY
Traces major developments in American sports history since the Civil War, including the professionalization of sports, race, women, mass media and free agency through lectures, films and discussion.

HIST 337-14 TOPICS IN AMERICAN HISTORY: EDIBLES: HISTORY OF FOOD AND CULTURE
Analyzes American cultures and society through the history of food production and consumption, investigating how the simple act of eating reveals interconnections. Considers food choices as biological, cultural, personal and political.

HIST 365-12, 13 TOPICS IN ASIAN & PACIFIC HISTORY: JAPAN’S WORLD WAR II
Examines World War II through the lens of Japanese analysts and observers and moves beyond "us vs them" dichotomies to explore world historical themes such as militarism, nationalism, imperialism, total war and racism.

HIST 400-10 CAPSTONE: ASIAN HISTORY: U.S.-CHINA RELATIONS
U.S.-China relations from 1784 to present will be discussed including the process in which the U.S. and China moved from friends to enemies during the past 2 centuries. Major historical events affecting the American, Chinese and East Asian history will be explored.

HIST 400-20 HISTORY CAPSTONE SEMINAR: CROSS-DRressing, IDENTITY AND GENDER IN HISTORY
Focus on questions of identity and gender and NOT sexuality or sexual preference through the use of plays, novels, memoirs, movies and more to examine the construction and development of gender distinctions from antiquity to the present.

HIST 400-30 CAPSTONE: POLITICAL ECONOMY OF THE MODERN U.S.
Introduces the managerial revolutions attendant upon the late 19th century advent of corporate capitalism; the changing face of modern opportunity & the characteristics of contemporary elites, among other subjects.

HLPR - Health Promotion

HLPR 467-11 PUBLIC HEALTH IN PRACTICE
Examines factors that lead to health inequities i.e.; educational, economic, disadvantage, food insecurity, trauma, and isolation. Explores the dilemma confronting policymakers, providers, and community members, through cases and presentations. Exposure to community engagement.

HLTH – Health

HLTH 667-10 EMPATHY & AFFECT RECOGNITION FOR HEALTHCARE PROFESSIONALS: A MINDFUL APPROACH
This is a hybrid (in-class/online) course that engages students in interdisciplinary approaches to understanding the experience of empathy and being an empathic provider, emotions and recognizing emotional states in others, as well as the fundamentals of mindfulness and mindful meditation.

MALS - Liberal Studies

MALS 626-10 STUDIES IN CONTEMPORARY CULTURES:: AMERICAN NIGHTMARES
Considers the tension in our culture between our aspirations, idealized by the notion of the American Dream, and our fears that things are--or are on the verge of--getting worse. We might call these fears American Nightmares. Explores these concerns about inequality, injustice, conspiracies, etc.
MAST - Marine Studies

MAST 267-11 BIOSTATISTICS FOR MOLECULAR ECOLOGY OF MARINE ENVIRONMENTS
Introduces the fundamental practices of statistics, emphasizing methods used in marine sciences. Topics - exploratory data analysis, correlation, regression, analysis of variance, analysis of frequencies, statistical graphics, basic experimental design and modern computer-intensive statistical methods.

MAST 667-27 ECONOMICS AND HUMAN COUPLING
Concerned w/coupling of human and natural systems in economics. It's intended to introduce students to the idea of coupling in economics and is suited for those with little/no background in economics looking to explore or those w/background in economics looking for applications tied to nature

MEEG - Mechanical Engineering

MEEG 867-11 NONLINEAR PROGRAMMING
Provides a comprehensive treatment of optimality conditions, Lagrange multiplier theory, and duality theory. Focuses on control and communications applications, and on resource allocation problems.

MSEG - Materials Science & Engineering

MSEG 667-19 MACROMOLECULAR DESIGN AND BIOCONJUGATIONS
Examines the strategies for sequence-specific orthogonality (e.g., "click" chemistry), protection and deprotection schemes, convergent versus divergent syntheses, grafting to versus grafting from approaches, solid-phase synthesis, polymer architectures, and purification.

MSEG 867-14 MATERIALS FOR OPTICS, NANOPHOTONICS, AND PLASMONICS
Covers the optical properties of bulk materials and low-dimensional structures including quantum wells and dots. Discusses emerging technologies such as photonic crystals, plasmonics, metamaterials, and nanophotonics. Presents new materials for optics.

NSCI – Neuroscience

NSCI 467-12 NEUROSCIENCE LAB
Provides neuroscience majors and minors with hands-on opportunities. From brain dissections to behavioral experiments, explores aspects of neuro-anatomy, neuro-physiology, animal behavior, experimental methods, and surgical techniques.

NSCI 467-13 NEUROLOGICAL DISORDERS
Consideration of the effects of damage to the nervous system in human beings, including both common disorders and rarer conditions that provide a window into complex aspects of brain function.

NSCI 467-15 SPATIAL COGNITION
This seminar will focus on the brain mechanisms that allow us to acquire information about our environment and use that information to navigate in space.

NSCI 467-80 LEARNING, MEMORY, & THE BRAIN
Surveys a variety of topics in the neurobiology of learning and memory. A multiple memory systems perspective is used to illustrate the diversity of brain systems and behavioral processes that govern overt behavior, affective states, and cognition in humans and experimental animals.

NTDT - Nutrition & Dietetics

NTDT 367-11 CULINARY MEDICINE
Blended course provides online learning, experiential lab experience, problem-based case studies in the practical application, translation of nutrition recommendations into food prep. Topics include basic preparation principles, recipe modifications for nutrition-related medical conditions/concerns. PREREQ: NTDT200
**NURS — Nursing**

**NURS 367-10 INTERPROFESSIONAL HEALTHCARE INFORMATICS**
Introduces students to healthcare informatics and helps them learn to work in interprofessional groups seeking innovative informatics solutions, to solve complex healthcare problems. Faculty from Nursing, Health Sciences and Public Policy encourage entrepreneurial thinking and learning.

**PHIL — Philosophy**

**PHIL 465-10, 80 POLITICAL AUTHORITY AND OBLIGATION**
States claim vast powers: they imprison wrongdoers, collect taxes, regulate markets, conscript soldiers, and so on. But state officials are just ordinary fallible human beings. Considers what entitles these people as officials to exercise these powers over others; and what justifies a state's claim to authority.

**PLSC - Plant Science**

**PLSC 267-10 WETLAND MONITORING AND ASSESSMENT**
includes hydrologic and biogeochemical monitoring, rapid assessment of ecological services and wetland condition, rapid assessment of hydrology, wetland classification, and wetland delineation. This is a hands-on course with considerable time spent in the field applying accepted methods.

**PLSC 367-11 CONTROLLED ENVIRONMENT AGRICULTURE FOR URBAN ENVIRONMENTS**
Hands-on and lecture-based introduction to controlled environment agriculture including the use of hydroponics for urban food production.

**POSC — Political Science**

**POSC 467-80 PREJUDICE, STEREOTYPING, AND DISCRIMINATION**
Examine stereotyping, prejudice, discrimination, and minority experience from a social psychological perspective. Moreover, the course will highlight the impact of self-relevant identities and political ideologies from a scientific perspective.

**PSYC — Psychology**

**PSYC 467-11 ADVANCED RESEARCH METHODS**
An advanced course in correlational and experimental research in the behavioral and social sciences with an emphasis on applied data analysis using statistical regression-based methods. Work in teams to critically read empirical research and formulate novel hypotheses.

**PSYC 467-13 ANTISOCIAL MINDS**
Focuses on understanding the origins of antisocial and criminal behavior from a psychological perspective. It covers a range of theoretical and empirical material so as to begin to understand the development of the 'antisocial mind.'

**PSYC 467-80 PREJUDICE, STEREOTYPING, AND DISCRIMINATION**
Examines stereotyping, prejudice, discrimination, and minority experience from a social psychological perspective. Highlights the impact of self-relevant identities and political ideologies from a scientific perspective.

**PSYC 867-10 PSYCHOLOGICAL STRESS AND THE PERIPHERY**
Discussion based course about the various ways that psychological stress can impact peripheral physiology in humans, including via the cardiovascular system, the immune system, and the HPA axis.

**PSYC 867-13 ANALYSIS OF CHANGE**
Reviews issues and methods for the analysis of change in behavioral and social sciences. Rationale, utility, and overlap of newer methods including latent growth approaches, latent change approaches, multilevel modeling, and growth mixture modeling.
UAPP - Urban Affairs & Public Policy

UAPP 467-19 URBAN & REGIONAL ANALYSIS
Addresses data sources, methods, and skills to analyze regions as economic, social, and spatial systems. Using data management and statistical and geospatial analysis tools to study regional conditions at scales ranging from neighborhoods to metropolitan areas.

UAPP 667-11 MACHINE LEARNING FOR PUBLIC POLICY
Surveys common machine learning (including AI) techniques used in analyses of academic/public/private sector data that impact decision making. Focus on qualitative & quantitative understanding of machine learning & appropriate use of data including uncertainties, model bias, & ethical considerations