Requirements for Completion:

A total of 15 credit hours is required to complete the certificate. There are two options:

- Option A is for students who have background in Urban and Regional Planning and related programs;
- Option B is for students with background in computer and information science or electronic and computer engineering or related fields.

Option A Requirements:

Urban and Regional Planning Methods (6 credits are required from the following courses)

- URP 6270 – Introduction to Planning Information Systems
- URP 6271 – Automation for Geospatial Modeling and Analysis
- URP 6272 – Urban Spatial Analysis
- URP 6276 – Internet Geographic Information Systems
- URP 6821 – Transportation and Land Use Modeling
- GEO 6166 – Advanced Quantitative Methods for Spatial Analysis

Data Science Cluster (3 credits are required)

- CAP 5771 – Introduction to Data Science
- STA 6166 -- Statistical Methods in Research I
- EEL 6533 – Data Analytics and Decision Sciences
- COP 5725 – Database Management Systems
- COP 6726 – Database System Implementation
- COP 6755 – Distributed Database Systems
- COT 5405 – Analysis of Algorithms
- COP 5536 – Advanced Data Structures

Artificial Intelligent Cluster (6 credits required)

- COT 5615 – Mathematics for Intelligent Systems (prerequisite of CAP 6610)
- CAP 6610 – Machine Learning
- CAP 5635 – Artificial Intelligence Concepts
- CAP 6615 – Neural Networks for Computing
- EEL 6935 – Big Data Ecosystems
- EEL 5840 – Elements of Machine Intelligence
- EEL 6814 – Neural Networks and Deep Learning
- EEL 6953 – Machine Learning for Natural Language Processing
- EEE 6512 – Image Processing and Computer Vision
- EEL 6825 – Pattern Recognition and Intelligent Systems
- EEL 6841 – Machine Intelligence and Synthesis
- EEL 6814 – Neural Networks and Deep

Option B Requirements:

Urban and Regional Planning Domain Knowledge (6 credits required from the following courses)

- URP 6100 – Planning Theory and History
- URP 6042 – Urban Economy
- URP 6131 – Land Use and Planning Law
- URP 6421 – Environmental Land-Use Planning and Management
- URP 6445 – Planning for Climate Change
- URP 6541 – Economic Development Planning
- URP 6716 – Transportation Policy and Planning
- URP 6711 – Transportation and Land Use Coordination
- URP 6745 – Housing, Public Policy and Planning

Urban and Regional Planning Methods (9 credit required from the following courses)

- URP 6270 – Introduction to Planning Information Systems
- URP 6271 – Automation for Geospatial Modeling and Analysis
- URP 6272 – Urban Spatial Analysis
- URP 6276 – Internet Geographic Information Systems
- URP 6821 – Transportation and Land Use Modeling
- GEO 6166 – Advanced Quantitative Methods for Spatial Analysis

The allowed timeframe for completion of this certificate is 3 years of initial enrollment in the graduate certificate program.

Course Descriptions:

URP Courses:

1. **URP 6042: Urban Economy** (3 credits)

   Principles of urban systems, including analytical techniques such as economic base analysis.

2. **URP 6061**: **Planning Administration and Ethics** (3 credits)

   Examine institutional and ethical decision-making frameworks within which planners carry out their day-to-day responsibilities and with which they relate to the wider world

3. **URP 6100**: **Planning Theory and History** (3 credits)

   Philosophy, theory, and history of inquiry into the processes of design, urban development systems.

4. **URP 6131**: **Land Use and Planning Law** (3 credits)

   The legal aspects of the allocation and development of land resources; private controls through covenants and easements; public regulation and control through zoning and subdivision regulation; social, economic, and political implications of land regulations

5. **URP 6270: Introduction to Planning Information Systems** (3 credits)

   Introduction to concepts and theory associated with desktop GIS as related to urban and regional (environmental) planning.

6. **URP 6271: Automation for Geospatial Modeling and Analysis** (3 credits)

   Covers methods and techniques for automating geospatial modeling and analysis for urban planning by using visual models, computer programming, and custom-built applications and tools that utilize Geographic Information Systems (GIS) technology in the context of planning information systems.

7. **URP 6272: Urban Spatial Analysis** (3 credits)

   Theoretical and practical knowledge about spatial relationships as applied to urban form and the development and analysis of urban environments using geographic information systems and spatial analysis techniques such as spatial statistical modeling.

8. **URP 6276: Internet Geographic Information Systems** (3 credits)

   Examines the theoretic and technological background in the emerging technologies in web-based geographic information systems (GIS).

9. **URP 6445: Planning for Climate Change** (3 credits)

   Overviewing the relationship between human activities and climate change and what can planning do to mitigate and adapt to climate change, including the science and scenarios of climate change, impacts on the built and natural environment, the mitigation measures, and adaptive planning approaches to build resilient communities.

10. **URP 6541: Economic Development Planning** (3 credits)

    Seminar on practice of local government planning with emphasis on development review and land development regulation.

11. **URP 6711: Transportation and Land Use Coordination** (3 credits)

    Introduction to transportation policy planning in urban context. Transportation policy

instruments and policy-making processes, critical issues in transportation policy, history of policy in U.S. at federal, state, and local levels.

12. **URP 6716: Transportation Policy and Planning** (3 credits)

    Explores the connection between land use and transportation by considering how four major sets of actors shape the urban environment: individuals, businesses, the professions and governments.

13. **URP 6745 – Housing, Public Policy and Planning** (3 credits)

    Supply, demand, and market relationships. History of government housing policy. Exploration of relationship between housing policy and urban and regional planning.

14. **URP 6821: Transportation and Land-Use Modeling** (3 credits)

    The planning process, modeling and applications for passenger transportation and land-use development of metropolitan areas with respect paid to its contribution to transportation project and policy analysis.

CIS Courses:

15. **CAP 5635: Artificial Intelligence Concepts**

    Heuristic search, game theory, knowledge representation, logic, machine learning, AI languages and tools. Applications such as planning, natural language understanding, expert systems, and computer vision.

16. **CAP 5771: Introduction to Data Science (3 credits)**

    Introducing the basics of data science including programming for data analytics, file management, relational databases, classification, clustering, and regression. The foundation is laid for big data applications ranging from social networks to medical and business informatics.

17. **CAP 6610: Machine Learning**

    This course covers concepts involved in developing computer programs that learn with experience with emphasis on methods based on probability, statistics, and optimization. Specific topics include discrete and continuous Generative Models and Clustering, Bayesian and Frequentist Statistics, Regression, Classification as Regression, Model Selection, Kernels, Gaussian Process Regression, and Markov modeling. Graphical models may be included if time permits.

18. **CAP 6615: Neural Networks for Computing**

    Neural network models and algorithms. Adaptive behavior, associative learning, competitive dynamics, and biological mechanisms. Applications include computer vision, cognitive information processing, control, and signal analysis.

19. **COT 5405: Analysis of Algorithms (3 credits)**

    Introduction and illustration of basic techniques for designing efficient algorithms and analyzing algorithm complexity.

20. **COP 5536: Advanced Data Structures (3 credits)**

    Development of efficient data structures used to obtain more efficient solutions to classical problems, such as those based on graph theoretical models, as well as problems that arise in

application areas of contemporary interest.

21. **COP 5556: Programming Language Principles (3 credits)**

    History of programming languages, formal models for specifying languages, design goals, run-time structures, and implementation techniques, along with survey of principal programming language paradigms.

22. **COT 5615: Mathematics for Intelligent Systems (3 credits)**

    Mathematical concepts commonly used in several areas of Intelligent Systems, including Computer Vision, Cybersecurity, Big Data / Data Science, Environmental Data Analysis, Human Centered Computing, Image and Signal Analysis, Machine Learning, Micro--and Macro--Biology, Neural Networks/Deep Learning, Sensor Networks, and Social Networks.

23. **COP 5725: Database Management Systems (3 credits)**
    Introduction to systems and procedures for managing large computerized databases, including queries, how to use databases like SQL servers, Microsoft Access, FileMaker Pro, and more.

24. **COP 6755: Distributed Database Systems**

    Distributed database systems including the areas of distributed database design, resource allocation, access plan selection, and transaction management.

ECE Courses:

25. **EEL 6533: Data Analytics and Decision Sciences**

    Hypothesis testing of signals in the presence of noise by Bayes, Neyman-Pearson, minimax criteria; estimation of signal parameters.

26. **EEL 5840: Elements of Machine Intelligence:**

    Overview of machine intelligence and the role of machine learning in variety of real-world problems in areas such as remote sensing and adaptive filtering. Probability and statistics to handle uncertain data. Learning models from data in both a supervised and unsupervised fashion. Linear models (e.g., linear discriminant analysis) and non-linear models (e.g., neural networks) for classification. Linear dimensionality reduction (e.g., principal components analysis).

27. **EEL 6814: Neural Networks and Deep Learning**

    Understand and utilize neural network concepts for signal processing and pattern recognition. Neural networks models will be explained from the point of view of nonlinear adaptive signal processing. Stress time varying models. Figures of merit for neural network design will also be covered.

28. **EEL 6935: Big Data Ecosystems**

    We will use all kinds of cloud resources for the course projects, including GENI, Amazon Web Services, Google Cloud, NSFCloud, and GatorCloud. This course involves intensive programming and extensive software systems. We use many professional tools for coding, project management, and documentation, e.g., Asana, Trello, GitHub, Google Drive etc.

29. **EEL 6953: Machine Learning for Natural Language Processing**

    The goal of natural language processing is to allow machines to understand and process human language. This course extends the knowledge presented in EEL-5840 Elements of Machine Intelligence to understand how machine learning methods can be applied to natural

language processing. During the first part of the course, fundamental concepts and methods used in natural language processing are introduced. During the second portion of the course, more recent machine learning-based approaches, particularly neural networks/deep-learning are presented.

30. **EEE 6512: Image Processing and Computer Vision:**

    This course introduces fundamental concepts and techniques for image processing and computer vision. We will address 1) how to efficiently represent and process image/video signals, and 2) how to deliver image/video signals over networks.

31. **EEL 6825: Pattern Recognition and Intelligent Systems**

    Decision functions; optimum decision criteria; training algorithms; unsupervised learning; feature extraction, data reduction; potential functions; syntactic pattern description; recognition grammars; machine intelligence.

32. **EEL 6841: Machine Intelligence and Synthesis**

    Theory of machine intelligence applied to general problem of engineering intelligent computer systems and architecture. Applications emphasized.

33. **EEL 6814: Neural Networks and Deep**

    Understand and utilize neural network concepts for signal processing and pattern recognition. Neural networks models will be explained from the point of view of nonlinear adaptive signal processing. Stress time varying models. Figures of merit for neural network design will also be covered.

Geography Course:

34. **GEO 6166: Advanced Quantitative Methods for Spatial Analysis**

    Critical examination and analysis of spatial data and point patterns, trend-surface modeling and interpolation, count data modeling, cluster and hot-spot detection, process change statistics in space and time, and spatial regression models.

Statistics Courses:

35. **STA 6166: Statistical Methods in Research I/II**

    To comprehend basic concepts of probability and statistics, and to make meaningful inferences on relevant datasets. II: To train graduate students in basic statistical tools with the aim of promoting sound scientific research based on good statistical thinking and practice.