Lehman College/City University of New York (CUNY)
Department of Earth, Environmental, and Geospatial Sciences

Description of Graduate Courses in MS-GISc Program

[R] = Required Core or Capstone Course

GEP 504 Basic Mapping Science: Applications and Analysis (3 credits, 4 hours)
This course provides a focus on mapping: how to use maps to obtain information about a wide variety of topics and how to create maps to display and analyze both quantitative and qualitative data. Discussions include mental maps, aerial photos, remotely sensed images, computer-assisted cartography, and Geographical Information Systems (GIS). Laboratory work includes digital map applications and GIS mapping exercises.

GEP 505 Principles of GISc (3 credits, 4 hours) **[R]**
The use of Geographic Information Systems in the teaching of social, earth, and life sciences. Demographic studies and graphic presentation of demographic analyses. The use of modern mapping techniques in studies of the Earth Environment.

GEP 602 Biogeography and GISc (4 credits, 5 hours)
The methods and techniques used to examine the past and current distribution of organisms, in the context of geophysical, evolutionary, and ecological processes. Study of the geographic ranges of living organisms and discussion of numerous relevant topics. Lab work will provide students with hands-on experience using GISc to explore such concepts as species distribution, island biogeography, and community fragmentation.

GEP 605 Special Projects in GISc: Environmental Analysis and Modeling with GISc (4 credits, 6 hours) **[R]**
Use of Geographic Information Systems for conducting research and spatial analyses in the natural and social sciences. The advanced use of computer mapping and spatial analysis technologies for studying the physical and human components of the Earth environment. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 606: Raster Analysis (3 credits, 4 hours)
Focusing on the structure and the various ways in which raster data can created, modified, and analyzed using a Geographic Information System (GIS). Topics include surface analysis, multi-criteria/multi-objective evaluation, and map algebra. The course combines lectures with weekly laboratory exercises designed to apply the concepts from the lectures and to develop students' expertise with GIS processing software. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 610 Spatial Analysis of Urban Health (3 credits, 4 hours)
This course focuses on urban health issues using a geographical framework and covers topics such as the historical perspective of health, place, and society; mapping and measuring health and health impacts; the social and spatial patterning of health; the geography of health inequalities and disparities; health and social/spatial mobility; and the effects of urban segregation, overcrowding, and poverty on disease. Current research, as well as the seminal early works on the geographies of health, will be reviewed. Geographic Information Science will be used in the laboratory exercises to illustrate the theoretical concepts and to produce worked examples of health geography.

GEP 620 Demography and Population Geography with GISc (3 credits, 4 hours)
The world's population in the context of geography and demography. The theoretical framework, defined by the fields of population geography and demography, will be studied and explored qualitatively and quantitatively. Data sources and acquisition, population metrics (growth, change distribution, and composition), population and food supply, mortality, fertility, and migration. Lab work will provide students with hands-on experience using GISc to explore demographic concepts.

GEP 621 Introduction to Remote Sensing (4 credits, 6 hours) **[R]**
Fundamentals of remote sensing: energy interactions between the sun, atmosphere, and features on the earth surface. Structure of raster data, cell size, and both passive and active remote sensing. Spatial, spectral, radiometric and temporal resolution characteristics of different multispectral remotely sensed data using specialized image analysis software. Students will also be exposed to a wide variety of applications in environmental mapping and monitoring, natural resources management, urban and regional planning, and global change research.

GEP 630 Geostatistics and Spatial Analytical Concepts (3 credits, 4 hours) **[R]**
Explores the emerging fields of geostatistics and spatial analysis. Various quantitative techniques will be studied and applied to real-world geographic problems. Exploratory spatial data analysis (ESDA) will be done within multiple GIS packages such as ArcGIS and GeoDa. Traditional statistics (e.g. incidence ratio, correlation, regression) as well as geo-statistics such as spatially-lagged regression, spatial error model, and geographically weighted regression (GWR) will be performed within various packages including SPSS, GWRIII, GeoDa, ArcGIS, [R], and Excel. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 631 Advanced Remote Sensing (4 credits, 5 hours)
Advanced processing and analysis of satellite remote sensing imagery with an emphasis on change detection, advanced image classification methods, and the
integrated use of remote sensing and GIS in geographical analysis. The course combines lectures with weekly laboratory exercises designed to apply the concepts from the lectures and develop students' expertise with remote sensing processing software. Prerequisite: GEP 621 or instructor's permission.

GEP 632 Environmental Health and GISc (3 credits, 4 hours)
This course explores the field of environmental health, especially focusing on spatial factors, medical geography, and the use of Geographic Information Science (GISc) to analyze relevant relationships between environmental impacts, diseases, demographics, socio-economic conditions, and the implications on public health and policy. Topics include environmental epidemiology, environmental toxicology, environmental justice, environmental policy, hazardous substances, air and water quality, food safety, global warming, population pressures, solid waste, occupational health, and risk assessment, as related to environmental health. Lab work uses GISc to examine and analyze environmental health, population, and built environment data for planning and research.

GEP 635 Natural Hazards and Risk Analysis (4 credits, 5 hours)
Fundamentals of the natural hazards and disasters origin; physical and social implications; methods of quantitative and qualitative analysis; elements of geographic, geological, social and political analysis applied to risk estimation and mitigation and management measures. Use of Geographic Information Systems (GIS) tools and analytical techniques in lab exercises and assignments. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 640 Urban Geography and GISc (3 credits, 4 hours)
This course covers the contribution of geographical concepts and methods to an understanding of contemporary and future urban issues. It applies the use of GISc to the study of the internal structure of cities and urban systems, including city dynamics, classic and postmodern models, central place theory, urban migration and mobility, race, ethnicity, and gender, urban migration, poverty, industrial and post-industrial urban societies, residential segregation, land use change, gentrification, urban and suburban sprawl, housing, urban environmental issues, and regional planning. Lab work involves using GISc to explore the form and function of urban areas, and to solve critical urban problems using spatial analysis.

GEP 641 Digital Image Analysis (4 credits, 5 hours)
Introduction to digital image analysis; application of digital analysis techniques to remote sensing data, including mapping of land cover, land use, vegetation, geology, soil, built-up area, agricultural land, and forest. Digital image

analysis techniques will include image processing, transformation, registration, and classification using industry standard digital image analysis software. Advantages and limitations of digital image analysis techniques will be discussed. Prerequisite: GEP 621 or instructor's permission

GEP 645 Water Resources, Hydrology, and GISc Analysis (4 credits, 5 hours)
Principles of hydrology and water resources; analysis of hydrologic data using open-source and commercial Geographic Information Systems (GIS). Statistical and spatial analysis, mapping of critical hydrologic conditions, coupling GIS with hydrologic data analysis and modeling. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 650 Topics in regional geography and applied mapping analysis (4 credits, 5 hours)
This field-based course will teach students basics of field data investigation and analysis using Geographic Information Systems (GIS) and Global Positioning System (GPS) within the context of the local (regional) geographic settings. Students will select the topic of regional investigation and use both, literature and local (regional) resources to conduct their own applied geographic study. Use of GIS for mapping and data entry will provide students with necessary skills for practical work with collected terrain data and satellite imagery. Labs will use field data and datasets from NASA, USGS, NOAA and local sources (universities, data portals, etc.)

GEP 660 Geovisualization and Analytical Cartography (4 credits, 6 hours)
Students will utilize advanced Geographic Information Science (GISc) and graphic design techniques in tandem with licensed and free software to produce maps and geovisualizations of complex spatial data with a focus on understanding cartographic conventions and principles of good cartographic design. Maps will be studied critically in terms of their production, interpretation, and relationship to space and place. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 662 Introduction to Programming for GISc (3 credits, 4 hours)
Programming and scripting for Geographic Information Science (GISc) with a focus on applying programming methods to answer geographic questions. Students will learn how to use programming to automate geoprocessing tasks and develop new analytical tools. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 664: Spatial Database Management (3 credits, 4 hours)
Spatial Database Management with a focus on managing spatial data within a relational database for use with Geographic Information Systems. In addition to learning relational database concepts and Structured Query Language (SQL), students will learn how to create and manage a spatial database, manage database security, maintain data integrity and model spatial relationships within the database, and work within a multiuser editing environment. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 670 Internship Seminar in GISc (4 credits, may be repeated up to 8 credits total) **[R – only for PEAR option]**
Current issues in Geographic Information Science(GISc), with weekly work as an intern in one of various governmental, non-profit, academic, or consulting organizations. Minimum 150 hours of GISc-related project work. Prerequisite: GEP 504 or GEP 505 AND instructor's permission.

GEP 675 Data Acquisition and Integration Methods for GISc Analysis (3 credits, 4 hours)
The techniques and science behind field methods commonly used for the acquisition and creation of geo-spatial data. Various techniques for data capture as well as processing and analyzing the data within a geographic information system (GIS). Labs will focus on the hardware and software needed for data creation, the integration of this information into a coherent GIS, and basic concepts of analysis including point-pattern analysis. Students will use GPS devices, mobile GIS, workstation GIS, as well as data from other sources including satellite and airborne remotely sensed data. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 680 Emerging Issues and Methods in Geographic Information Science (3 credits, 4 hours. May be repeated up to 9 credits)
Current and innovative issues, technologies, and methods in the field of Geographic Information Science. Topics change from term to term, and might include Ethics in GISc; Critical Cartography; and New Technologies for Analysis. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 689 Methods Seminar in Geographic Information Science (GISc) (3 credits, 4 hours)
Current methods in the field of Geographic Information Science. The nature of scientific research, defining geographic problems, issues of scale and resolution, research design, scientific literature review, acquisition of relevant data, capturing information and mapping in GIS, analysis and interpretation of data, presenting scientific findings in written and oral formats. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 690 Workshop in Geographic Information Science Research (4 credits) **[R – only for PEAR option]**
An advanced examination of mapping and of new computer-aided technologies in the natural and social sciences, including research design and methodology and designing and conducting an independent GIS research project, conforming to generally acceptable professional geographical practices and techniques, under the supervision of faculty. Prerequisite: GEP 504 or GEP 505 or instructor's permission.

GEP 691 Independent Study in GISc (2, 3, or 4 hours, may be repeated up to 8 credits total)
Prerequisite: Instructor's permission
Readings, analysis, and/or an in-depth examination in a topic in geography.

GEP 695 Thesis Research in GISc (4 or 8 credits) **[R – only for Thesis option]**
Preparation for Master's degree research and thesis writing in the GISc graduate program. A substantive and meaningful GISc research project is undertaken and a written thesis is prepared, using appropriate research methods in the field of GISc, demonstrating sufficient understanding of the nature of scientific research, the process of defining geographic problems, issues of scale and resolution, formation of research design, scientific literature review, acquisition of relevant data, capturing information and mapping in GIS, analysis and interpretation of data, presenting scientific findings in written and oral formats. Open only to students matriculated for the M.Sc. degree in GISc. Prerequisite: GEP 605

Photos from left: Gillet Hall, home of the Earth, Environmental, and Geospatial Sciences Dept., at Lehman College's lovely campus near the #4 and the D train lines; Graduate student researcher in the Urban GISc Lab; GISc Teaching Lab; Students in the "Workshop in GISc Research" class.

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