Informatics (IN4MATX)

Courses

IN4MATX 12. Barter to Bitcoin: Society, Technology and the Future of Money. 4 Units.
Digital money has captured the broad imagination of speculators, coders, regulators, criminals and the mass media. Course puts this change in context: how do we understand money as a social, political and technological phenomenon? Course may be offered online.

Same as SOC SCI 11A.

(II, III)

IN4MATX 41. Informatics Core Course I. 6 Units.
Fundamental concepts of computer software design and construction. Data, algorithms, functions, and abstractions. Overview of computer systems: data representation, architectural components, operating systems, networks. Introduction to information systems: parties involved, architectural alternatives, usability, organizational and social concerns.

Restriction: IN4MATX 41 may not be taken for credit if taken after I&C SCI 22 or CSE 22.

(II, Vb)

IN4MATX 42. Informatics Core Course II. 6 Units.
Alternative data structure implementations; analysis of time and space efficiency. Object-oriented programming concepts and techniques: classes, objects, inheritance, interfaces. Formal languages and automata. Problem modeling and design tradeoffs.

Prerequisite: IN4MATX 41. IN4MATX 41 with a grade of C or better.
Overlaps with I&C SCI 32, CSE 42, I&C SCI 33, CSE 43, I&C SCI 22, CSE 22.

(II, Vb)

IN4MATX 43. Introduction to Software Engineering. 4 Units.
Concepts, methods, and current practice of software engineering. Large-scale software production, software life cycle models, principles and techniques for each stage of development.

Overlaps with I&C SCI 52, I&C SCI 105.

IN4MATX 44. Seminar in Informatics Research Topics. 2 Units.
Introduction to current research topics in Informatics. Various faculty members present current research and relate it to the course content of the Informatics degree program.

Grading Option: Pass/no pass only.

IN4MATX 45. Patterns of Software Construction. 4 Units.
Building software applications; reusing and integrating components; designing for reuse. Effective use of libraries and APIs, file and network I/O, creation of user interfaces.

Prerequisite: IN4MATX 42 or I&C SCI 22 or CSE 22 or I&C SCI H22. I&C SCI H22 with a grade of C or better.

(Vb)

IN4MATX 101. Concepts in Programming Languages I. 4 Units.
In-depth study of several contemporary programming languages stressing variety in data structures, operations, notation, and control. Examination of different programming paradigms, such as logic programming, functional programming and object-oriented programming; implementation strategies, programming environments, and programming style. Course may be offered online.

Prerequisite: (IN4MATX 42 or I&C SCI 51 or CSE 31 or EECS 31) and (IN4MATX 45 or I&C SCI 46 or CSE 46 or I&C SCI 33 or CSE 43). IN4MATX 42 with a grade of C or better. I&C SCI 51 with a grade of C or better. CSE 31 with a grade of C or better. EECS 31 with a grade of C or better. IN4MATX 45 with a grade of C or better. I&C SCI 46 with a grade of C or better. CSE 46 with a grade of C or better. I&C SCI 33 with a grade of C or better. CSE 43 with a grade of C or better.

Same as CSE 141, COMPSCI 141.
IN4MATX 102. Concepts of Programming Language II. 4 Units.
In-depth study of major programming paradigms: imperative, functional, declarative, object-oriented, and aspect-oriented. Understanding the role of programming languages in software development and the suitability of languages in context. Domain-specific languages. Designing new languages for better software development support.
Prerequisite: IN4MATX 101 or COMPSCI 141 or CSE 141. CSE 141 with a grade of C or better.

IN4MATX 113. Requirements Analysis and Engineering. 4 Units.
Aims to equip students to develop techniques of software-intensive systems through successful requirements analysis techniques and requirements engineering. Students learn systematic process of developing requirements through cooperative problem analysis, representation, and validation.
Prerequisite: IN4MATX 42 or I&C SCI 22 or CSE 22 or I&C SCI 33 or CSE 43 and (IN4MATX 43 or I&C SCI 52). IN4MATX 42 with a grade of C or better. I&C SCI 22 with a grade of C or better. CSE 22 with a grade of C or better. I&C SCI 33 with a grade of C or better. CSE 43 with a grade of C or better. IN4MATX 43 with a grade of C or better. I&C SCI 52 with a grade of C or better.

IN4MATX 115. Software Testing, Analysis, and Quality Assurance. 4 Units.
Preparation for developing high-quality software through successful verification and validation techniques. Fundamental principles of software testing, implementing software testing practices, ensuring the thoroughness of testing to gain confidence in the correctness of the software.
Prerequisite: (I&C SCI 45J or I&C SCI 45C or I&C SCI 65 or I&C SCI 23 or CSE 23 or I&C SCI 46 or CSE 46 or IN4MATX 45) and (IN4MATX 43 or I&C SCI 52). I&C SCI 45J with a grade of C or better. I&C SCI 45C with a grade of C or better. I&C SCI 65 with a grade of C or better. I&C SCI 23 with a grade of C or better. CSE 23 with a grade of C or better. I&C SCI 46 with a grade of C or better. CSE 46 with a grade of C or better. IN4MATX 45 with a grade of C or better. IN4MATX 43 with a grade of C or better. I&C SCI 52 with a grade of C or better.

IN4MATX 117. Project in Software System Design. 4 Units.
Specification, design, construction, testing, and documentation of a complete software system. Special emphasis on the need for and use of teamwork, careful planning, and other techniques for working with large systems.
Prerequisite: (IN4MATX 43 or I&C SCI 52) and (I&C SCI 33 or CSE 43 or I&C SCI 22 or CSE 22 or IN4MATX 42) I&C SCI 52 with a grade of a C or better. IN4MATX 42 with a grade of C or better.
Restriction: Upper-division students only.

IN4MATX 121. Software Design: Applications. 4 Units.
Introduction to application design: designing the overall functionality of a software application. Topics include general design theory, software design theory, and software architecture. Includes practice in designing and case studies of existing designs.
Prerequisite: IN4MATX 45 or I&C SCI 23 or CSE 23 or I&C SCI 33 or CSE 43. IN4MATX 45 with a grade of C or better. I&C SCI 23 with a grade of C or better. CSE 23 with a grade of C or better. I&C SCI 33 with a grade of C or better. CSE 43 with a grade of C or better.
Restriction: Upper-division students only.

IN4MATX 122. Software Design: Structure and Implementation. 4 Units.
Introduction to implementation design: designing the internals of a software application. Topics include design aesthetics, design implementation, design recovery, design patterns, and component reuse. Includes practice in designing and case studies of existing designs.
Prerequisite: (I&C SCI 45J or I&C SCI 46 or IN4MATX 45) and (IN4MATX 101 or COMPSCI 141 or CSE 141).

IN4MATX 123. Software Architecture. 4 Units.
Prepares students to engineer well-structured software systems. Students learn a wide range of software architectural styles, architectural platforms that provide standard services to applications, and formal architecture description languages.
Prerequisite: IN4MATX 122 or ((IN4MATX 101 or COMPSCI 141 or CSE 141) and IN4MATX 113).

IN4MATX 124. Internet Applications Engineering. 4 Units.
Concepts in Internet applications engineering with emphasis on the Web. Peer-to-Peer and Interoperability. Topics include HTTP and REST, Remote Procedure/Method Calls, Web Services, data representations, content distribution networks, identity management, relevant W3C/IETF standards, and relevant new large-scale computing styles.
Prerequisite: COMPSCI 132.
Same as COMPSCI 137.
Restriction: Upper-division students only.
IN4MATX 125. Computer Game Development. 4 Units.
Introduction to the principles of interactive 2D and 3D computer game development. Concepts in computer graphics, algorithms, software engineering, art and graphics, music and sound, story analysis, and artificial intelligence are presented and are the basis for student work.

Prerequisite: COMPSCI 112 or COMPSCI 171 or IN4MATX 121 or ART 106B or I&C SCI 163 or I&C SCI 166.

Same as COMPSCI 113.

IN4MATX 131. Human Computer Interaction. 4 Units.
Basic principles of human-computer interaction (HCI). Introduces students to user interface design techniques, design guidelines, and usability testing. Students gain the ability to design and evaluate user interfaces and become familiar with some of the outstanding research problems in HCI.

Prerequisite: IN4MATX 41 or I&C SCI 10 or I&C SCI 21 or CSE 21 or I&C SCI H21 or I&C SCI 31 or CSE 41 or ENGR 10 or ENGRMAE 10 or EECS 10. IN4MATX 41 with a grade of C or better. I&C SCI 10 with a grade of C or better. I&C SCI 21 with a grade of C or better. CSE 21 with a grade of C or better. I&C SCI H21 with a grade of C or better. I&C SCI 31 with a grade of C or better. CSE 41 with a grade of C or better. ENGR 10 with a grade of C or better. ENGRMAE 10 with a grade of C or better. EECS 10 with a grade of C or better.

Restriction: Upper-division students only.

IN4MATX 132. Project in Human-Computer Interaction Requirements and Evaluation. 4 Units.
Students undertake significant projects in the elicitation and specification of HCI requirements and the thorough evaluation of user interfaces.

Prerequisite: IN4MATX 131.

IN4MATX 133. User Interaction Software. 4 Units.

Prerequisite: IN4MATX 45 or I&C SCI 23 or CSE 23 or ((I&C SCI 33 or CSE 43) and I&C SCI 45J). IN4MATX 45 with a grade of C or better. I&C SCI 23 with a grade of C or better. CSE 23 with a grade of C or better. I&C SCI 33 with a grade of C or better. CSE 43 with a grade of C or better. I&C SCI 45J with a grade of C or better.

IN4MATX 134. Project in User Interaction Software. 4 Units.
Students complete an end-to-end user interface programming project based on an iterative design paradigm. Topics may include requirements brainstorming, paper prototyping, iterative development, cognitive walk-through, quantitative evaluation, and acceptance testing. Materials fee.

Prerequisite: IN4MATX 131 and IN4MATX 133.

IN4MATX 141. Information Retrieval. 4 Units.
An introduction to information retrieval including indexing, retrieval, classifying, and clustering text and multimedia documents.

Prerequisite: (IN4MATX 45 or I&C SCI 46 or CSE 46 or ((I&C SCI 33 or CSE 43) and I&C SCI 45J)) and (STATS 7 or STATS 67). IN4MATX 45 with a grade of C or better. I&C SCI 46 with a grade of C or better. CSE 46 with a grade of C or better. I&C SCI 33 with a grade of C or better. CSE 43 with a grade of C or better. I&C SCI 45J with a grade of C or better.

Same as COMPSCI 121.

IN4MATX 143. Information Visualization. 4 Units.
Introduction to interactive visual interfaces for large datasets, and to principles of human visual perception and human computer interaction that inform their design. Various applications for data analysis and monitoring are discussed.

Prerequisite: IN4MATX 131 or I&C SCI 52 or ((IN4MATX 43 and (I&C SCI 31 or CSE 41 or I&C SCI 21 or CSE 21 or IN4MATX 41)). IN4MATX 131 with a grade of C or better. I&C SCI 52 with a grade of C or better. IN4MATX 43 with a grade of C or better. I&C SCI 31 with a grade of C or better. CSE 41 with a grade of C or better. I&C SCI 21 with a grade of C or better. CSE 21 with a grade of C or better. IN4MATX 41 with a grade of C or better.

IN4MATX 148. Project in Ubiquitous Computing. 4 Units.
Introduction to ubiquitous computing research methods, tools, and techniques. Prototyping, design, and evaluation of physical computing applications, smart environments, embedded systems, and future computing scenarios. Includes hands-on in-class laboratory exercises. Materials fee.

Prerequisite: I&C SCI 10 or I&C SCI 21 or CSE 21 or I&C SCI 31 or CSE 41 or IN4MATX 41. I&C SCI 10 with a grade of C or better. I&C SCI 21 with a grade of C or better. CSE 21 with a grade of C or better. I&C SCI 31 with a grade of C or better. CSE 41 with a grade of C or better. IN4MATX 41 with a grade of C or better.

Restriction: Upper-division students only.
IN4MATX 151. Project Management. 4 Units.
Introduces theoretical and practical aspects of project management. Topics include organizational theory, group behavior, project management skills, case studies, personal and group productivity tools, management of distributed work, stakeholders, consultants, and knowledge management. Students do a project exercise.

Prerequisite: IN4MATX 43 or I&C SCI 52. I&C SCI 52 with a grade of C or better.

Restriction: Upper-division students only.

IN4MATX 153. Computer Supported Cooperative Work. 4 Units.
Introduces concepts and principles of collaborative systems. Topics may include shared workspaces, group interaction, workflow, architectures, interaction between social and technical features of group work, and examples of collaborative systems used in real-world settings. Students develop a simple collaborative application.

Prerequisite: (IN4MATX 161 or I&C SCI 52 or IN4MATX 43) and (I&C SCI 31 or CSE 41 or I&C SCI 21 or CSE 21 or IN4MATX 41). I&C SCI 52 with a grade of C or better. I&C SCI 31 with a grade of C or better. CSE 41 with a grade of C or better. I&C SCI 21 with a grade of C or better. CSE 21 with a grade of C or better. IN4MATX 41 with a grade of C or better.

IN4MATX 161. Social Analysis of Computerization. 4 Units.
Introduction of computerization as a social process. Examines the social opportunities and problems raised by new information technologies, and the consequences of different ways of organizing. Topics include computerization and work life, privacy, virtual communities, productivity paradox, systems risks.

Prerequisite: Satisfactory completion of the Lower-Division Writing requirement. IN4MATX 41 or I&C SCI 10 or I&C SCI 21 or CSE 21 or I&C SCI 31 or CSE 41 or ENGR 10 or EECS 10 or ENGRMAE 10. IN4MATX 41 with a grade of C or better. I&C SCI 10 with a grade of C or better. I&C SCI 21 with a grade of C or better. CSE 21 with a grade of C or better. I&C SCI 31 with a grade of C or better. CSE 41 with a grade of C or better. ENGR 10 with a grade of C or better. EECS 10 with a grade of C or better. ENGRMAE 10 with a grade of C or better.

IN4MATX 162W. Organizational Information Systems. 4 Units.
Introduction to role of information systems in organizations, components and structure of organizational information systems, and techniques used in information systems analysis, design, and implementation.

Prerequisite: IN4MATX 161. Satisfactory completion of the Lower-Division Writing requirement.

IN4MATX 163. Project in the Social and Organizational Impacts of Computing. 4 Units.
Students undertake projects intended to gather and analyze data from situations in which computers are used, organize and conduct experiments intended to test hypotheses about impacts, and explore the application of concepts learned in previous courses.

Prerequisite: IN4MATX 162.

IN4MATX 171. Introduction to Medical Informatics. 4 Units.
Broad overview of medical informatics for students with varied backgrounds. Electronic medical records, online resources, mobile technologies, patient safety, and computational design. Legal, ethical, and public policy issues. Health systems management. Evaluation and fieldwork for health systems.

Same as PUBHLTH 105.

Restriction: Upper-division students only.

IN4MATX 172. Project in Health Informatics. 4 Units.
Students undertake significant quarter-long projects related to health informatics. Topics may include field evaluations of health care technologies, prototypes, iterative design, and system implementations.

Prerequisite: PUBHLTH 105 or IN4MATX 171.

Same as PUBHLTH 106.

IN4MATX 190. Special Topics in Informatics. 4 Units.
Studies in selected areas of informatics. Topics addressed vary each quarter.

Prerequisite: Prerequisites vary.

Repeatability: Unlimited as topics vary.
IN4MATX 191A. Senior Design Project. 4 Units.
Group supervised project in which students analyze, specify, design, construct, evaluate, and adapt a significant information processing system. Topics include team management, professional ethics, and systems analysis.

Prerequisite: Prerequisite or corequisite: IN4MATX 123 or IN4MATX 124. Prerequisite: IN4MATX 121 and IN4MATX 131 and IN4MATX 151 and IN4MATX 161.

Restriction: Upper-division students only.

IN4MATX 191B. Senior Design Project. 4 Units.
Group supervised project in which students analyze, specify, design, construct, evaluate, and adapt a significant information processing system. Topics include team management, professional ethics, and systems analysis.

Prerequisite: IN4MATX 191A.

Grading Option: In progress only.

IN4MATX 191C. Senior Design Project. 4 Units.
Group supervised project in which students analyze, specify, design, construct, evaluate, and adapt a significant information processing system. Topics include team management, professional ethics, and systems analysis.

Prerequisite: IN4MATX 191B.

IN4MATX H198. Honors Research. 4 Units.
Directed independent research in Informatics for honors students.

Prerequisite: Satisfactory completion of the Lower-Division Writing requirement.

Repeatability: May be repeated for credit unlimited times.

Restriction: Bren School of ICS Honors Program or the Campuswide Honors Program students only.

IN4MATX 199. Individual Study. 2-5 Units.
Individual research or investigation under the direction of an individual faculty member.

Repeatability: May be repeated for credit unlimited times.

IN4MATX 201. Research Methodology for Informatics. 4 Units.
Introduction to strategies and idioms of research in Informatics. Includes examination of issues in scientific inquiry, qualitative and quantitative methods, and research design. Both classic texts and contemporary research literature are read and analyzed.

IN4MATX 203. Qualitative Research Methods in Information Systems. 4 Units.
Introduction to qualitative research methods used to study computerization and information systems, such as open-ended interviewing, participant observation, and ethnography. Studies of the methods in practice through examination of research literature.

Prerequisite: IN4MATX 261 or IN4MATX 251.

IN4MATX 205. Quantitative Research Methods in Information Systems. 4 Units.
Quantitative research methods used to study computerization and information systems. Design of instruments, sampling, sample sizes, and data analysis. Validity and reliability. Longitudinal versus cross-sectional designs. Analysis of secondary data. Studies of the methods through examination of research literature.

Prerequisite: (IN4MATX 251 or IN4MATX 261) and basic knowledge of elementary statistics.

IN4MATX 207S. Doctoral Seminar on Research and Writing. 2 Units.
Doctoral seminar centered on original research and writing. Provides a chance for doctoral students at all levels to present original work, brainstorm ongoing issues, and learn to provide and receive critical feedback from peers.

Grading Option: Satisfactory/unsatisfactory only.

Repeatability: May be repeated for credit unlimited times.

IN4MATX 209S. Seminar in Informatics. 2 Units.
Current research and research trends in informatics. Forum for presentation and criticism by students of research work in progress.

Repeatability: Unlimited as topics vary.
IN4MATX 211. Software Engineering. 4 Units.
Study of the concepts, methods, and tools for the analysis, design, construction, and measurement of complex software-intensive systems. Underlying principles emphasized. State-of-the-art software engineering and promising research areas covered, including project management.

IN4MATX 212. Analysis of Programming Languages. 4 Units.
Concepts in modern programming languages, their interaction, and the relationship between programming languages and methods for large-scale, extensible software development. Empirical analysis of programming language usage.

IN4MATX 214. Requirements Engineering and Specification. 4 Units.
Study of rigorous techniques in requirements engineering – requirements definition phase of software development – with focus on modeling and specification. Topics include notations and models for requirements specification; and methods, tools and processes for software requirements elicitation, representation, analysis.

Restriction: Graduate students only.

IN4MATX 215. Software Analysis and Testing. 4 Units.
Studies techniques for developing confidence in software from traditional testing schemes to integrated, multitechnique analytic approaches. Considers strengths and weaknesses and explores opportunities for synergistic technique application. Emphasis is on approaches integrated into the software process.

IN4MATX 217. Software Processes. 4 Units.
Explores vehicles for modeling, coding, and analyzing software processes. Considers integration of software process programming approaches with traditional management issues. Explores the use of software process execution as a vehicle for effective integration of tools into environments.

IN4MATX 219. Software Environments. 4 Units.
Study of the requirements, concepts, and architectures of comprehensive, integrated, software development and maintenance environments. Major topics include process support, object management, communication, interoperability, measurement, analysis, and user interfaces in the environment context.

IN4MATX 221. Software Architecture. 4 Units.
Study of the concepts, representation techniques, development methods, and tools for architecture-centric software engineering. Topics include domain-specific software architectures, architectural styles, architecture description languages, software connectors, and dynamism in architectures.

IN4MATX 223. Applied Software Design Techniques. 4 Units.
Study of concepts, representations, techniques, and case studies in structuring software systems, with an emphasis on design considerations. Topics include static and dynamic system structure, data models, abstractions, naming, protocols and application programmer interfaces.

IN4MATX 225. Information Retrieval, Filtering, and Classification. 4 Units.
Algorithms for the storage, retrieval, filtering, and classification of textual and multimedia data. The vector space model, Boolean and probabilistic queries, and relevance feedback. Latent semantic indexing; collaborative filtering; and relationship to machine learning methods.

Prerequisite: COMPSCI 161 and COMPSCI 171 and (I&C SCI 6N or MATH 3A or MATH 6G).

Same as COMPSCI 221.

Restriction: Graduate students only.

IN4MATX 231. User Interface Design and Evaluation. 4 Units.
Introduction to the design and evaluation of user interfaces, with an emphasis on methodology. Cognitive principles, design life cycle, on-line and off-line prototyping techniques. Toolkits and architectures for interactive systems. Evaluation techniques, including heuristic and laboratory methods.

IN4MATX 232. Research in Human-Centered Computing. 4 Units.
Introduction to contemporary topics in human-computer interaction, including methods, technologies, design, and evaluation. Emerging application domains and their challenges to traditional research methods. Advanced architectures and technologies. Critical issues.

Prerequisite: Some familiarity with HCI principles.

IN4MATX 233. Knowledge-Based User Interfaces. 4 Units.
Concepts related to the development of interactive software systems with a focus on knowledge-based tools and human-centered design. Topics span the fields of human-computer interaction, software engineering, and knowledge representation.

Prerequisite: COMPSCI 171.
IN4MATX 235. Advanced User Interface Architecture. 4 Units.
Architectural concerns in advanced interactive systems. The design of current and emerging platforms for novel interactive systems. Paradigms such as constraint-based programming, multimodal interaction, and perceptual user interfaces for individual, distributed, and ubiquitous applications.

IN4MATX 241. Introduction to Ubiquitous Computing. 4 Units.
The "disappearing computer" paradigm. Differences to the desktop computing model: applications, interaction in augmented environments, security, alternate media, small operating systems, sensors, and embedded systems design. Evaluation by project work and class participation.

Same as COMPSCI 248A.

IN4MATX 242. Ubiquitous Computing and Interaction. 4 Units.
Principles and design techniques for ubiquitous computing applications. Conceptual basis for tangible and embodied interaction. Interaction in virtual and augmented environments. Design methods and techniques. Design case studies. Examination by project work.

Prerequisite: IN4MATX 231 and IN4MATX 241.

Same as COMPSCI 248B.

IN4MATX 244. Introduction to Embedded and Ubiquitous Systems. 4 Units.
Embedded and ubiquitous system technologies including processors, DSP, memory, and software. System interfacing basics; communication strategies; sensors and actuators, mobile and wireless technology. Using pre-designed hardware and software components. Design case studies in wireless, multimedia, and/or networking domains.

Prerequisite: I&C SCI 51 and COMPSCI 152 and COMPSCI 161 and (I&C SCI 6N or MATH 3A or MATH 6G or I&C SCI 6D) or B.S. degree in Computer Science.

Same as COMPSCI 244.

IN4MATX 251. Computer-Supported Cooperative Work. 4 Units.
The role of information systems in supporting work in groups and organizations. Examines various technologies designed to support communication, information sharing, and coordination. Focuses on behavioral and social aspects of designing and using group support technologies.

IN4MATX 261. Social Analysis of Computing. 4 Units.
The social and economic impacts of computing and information technologies on groups, organizations, and society. Topics include computerization and changes in the character of work, social control and privacy, electronic communities, and risks of safety-critical systems to people.

IN4MATX 263. Computerization, Work, and Organizations. 4 Units.
Selected topics in the influence of computerization and information systems in transforming work and organizations. Theories of organization and organizational change. Processes by which diverse information technologies influence changes in work and organizations over short and long time periods.

Prerequisite: IN4MATX 251 or IN4MATX 261.

IN4MATX 265. Theories of Computerization and Information Systems. 4 Units.
Social and economic conceptions of information technology. Macrosocial and economic conditions that foster changes in information technologies. Social construction of information and computer technology in professional worlds. Theories of information technology and large-scale social change.

Prerequisite: IN4MATX 251 or IN4MATX 261.

IN4MATX 267. Digital Media and Society. 4 Units.
Selected topics in the technological and social aspects of online interactions, and policy including online games, social media, electronic activism, e-commerce, and digital libraries. Media-theoretic approaches to digital technology. Architectures, infrastructure considerations, and their consequences.

Prerequisite: IN4MATX 251 or IN4MATX 261.

IN4MATX 269. Computer Law. 4 Units.

Restriction: Graduate students only.

IN4MATX 273. Information Technology in Global Sustainability. 4 Units.
Explores the relationship between recent developments in information technology and the global transition to sustainability. Topics include the role of IT systems in the provision of human needs and wants (e.g., smart grids, food systems, and other IT-enabled infrastructure).

Restriction: Graduate students only.
IN4MATX 290. Research Seminar. 2 Units.
Forum for presentation and criticism by students of research work in progress. Presentation of problem areas and related work. Specific goals and progress of research.
Grading Option: Satisfactory/unsatisfactory only.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.

IN4MATX 291S. Literature Survey in Software Engineering. 2 Units.
Reading and analysis of relevant literature in Software Engineering under the direction of a faculty member.
Repeatability: May be repeated for credit unlimited times.

IN4MATX 295. Special Topics in Informatics. 4 Units.
Studies in selected areas of informatics. Topics addressed vary each quarter.
Repeatability: Unlimited as topics vary.
Restriction: Graduate students only.

IN4MATX 298. Thesis Supervision. 2-12 Units.
Individual research or investigation conducted in preparation for the M.S. thesis option or the dissertation requirements for the Ph.D. program.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.

IN4MATX 299. Individual Study. 2-12 Units.
Individual research or investigation under the direction of an individual faculty member.
Repeatability: May be repeated for credit unlimited times.
Restriction: Graduate students only.