460. Critical Perspectives in Communication
Spring. 4(4-0)
R: Open only to Communication majors. The role and function of media, and their impact on society.

475. Communication Campaign Design and Analysis (W)
Fall. 4(4-0)
R: Open only to Communication majors. The design and analysis of communication campaigns.

490. Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course.

494. Practicum in Communication Research and Instruction
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course.

800. Communication Programs and Evaluation
Fall. 3(3-0)
R: Open only to Communication majors. Supervised practical experience in a professional environment.

801. Communication Research I
Fall. 4(4-0)
R: Open only to Communication majors. The design and analysis of communication campaigns.

820. Communication Theory and Process
Fall. 3(3-0)
R: Open only to Communication majors. Theoretical models of communication with emphasis on the applications of communication theory to various professional communication areas.

826. Cross-Cultural Communication
Spring. 3(3-0)
R: Open only to Communication majors. The role and function of media, and their impact on society.

828. Critical Perspectives in Communication
Spring. 4(4-0)
R: Open only to Communication majors. The role and function of media, and their impact on society.

855. Codes and Code Systems
Spring. 4(4-0)
R: Open only to Communication majors. The role and function of media, and their impact on society.

960. Persuasion
Fall. 3(3-0)
R: Open only to Communication majors. The role and function of media, and their impact on society.

975. Communication Campaign Design and Analysis (W)
Fall. 4(4-0)
R: Open only to Communication majors. The design and analysis of communication campaigns.

990. Independent Study
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course.

992. Special Topics
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 16 credits in all enrollments for this course.

993. Internship
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course.

994. Practicum in Communication Research and Instruction
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course.

995. Communication Research II
Fall. 4(4-0)
R: Open only to Communication majors. Supervised practical experience in a professional environment.

996. Communication Theory and Process
Fall. 3(3-0)
R: Open only to Communication majors. Theoretical models of communication with emphasis on the applications of communication theory to various professional communication areas.
131. **Introduction to Technical Computing**
Fall, Spring. 3(3-0)
P: MTH 103 or MTH 110 or MTH 116; or MTH 120 or MTH 124 or MTH 132 or concurrently.
Computing systems and applications. Design and implementation of programs using FORTRAN. Examples from engineering, mathematics and science.

230. **Algorithms and Computing**
Fall, Spring. 4(4-0)
P: LBS 116 or MTH 120 or MTH 124 or MTH 132.

260. **Discrete Structures in Computer Science**
Fall, Spring. 3(3-0)
P: MTH 133.

290. **Independent Study in Computer Science**
Fall, Spring. 1 credit. A student may earn a maximum of 3 credits in all enrollments for this course. R: Approval of department; application required. Supervised individual study in an area of computer science.

291. **Selected Topics in Computer Science**
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of department. Topics selected to supplement and enrich existing courses and lead to the development of new courses.

320. **Computer Organization and Assembly Language Programming**
Fall, Spring. 4(4-0)
P: CPS 230, CPS 260. R: Not open to students with credit in EE 331.
Machine representation of data and instructions. Machine organization, primary storage, registers, arithmetic logic unit, control unit, operations. Assembly language programming, interface to high level languages. Assemblers and loaders.

330. **Data Structures and Programming Concepts**
Fall, Spring. 4(4-0)
P: CPS 230, CPS 260.
Data types and structures. Algorithms including searching, sorting and hashing. Program correctness, program analysis. Abstract data types including stacks, queues, and trees. Object-oriented programming, introduction to various program libraries.

360. **Automata and Formal Language Theory**
Fall, Spring. 3(3-0)

410. **Operating Systems**
Fall, Spring. 4(4-0)
P: CPS 320; CPS 360 or EE 331. R: Open only to Computer Science, Computer Engineering, Electrical Engineering, and LBS Computer Science majors.

420. **Computer Architecture**
Fall, Spring. 4(4-0)
P: CPS 320; EE 331 or CPS 320, CPS 360. R: Open only to Computer Science, Computer Engineering, Electrical Engineering, and LBS Computer Science majors.
Digital logic and sequential machine design. Computer organization, control unit and arithmetic logic unit implementation. Input-output, memory organization, parallel operations. Digital system simulation.

422. **Computer Networks**
Fall, Spring. 3(3-0)
P: STT 351; CPS 320 or EE 331; CPS 410 or concurrently. R: Open only to Computer Science, Computer Engineering, Electrical Engineering, and LBS Computer Science majors.
Computer network architectures and models. Medium access control. Physical, data link, network, transport, and session layers. Local-area and wide-area networks.

440. **Artificial Intelligence and Symbolic Programming**
Fall, 4(4-2)
P: CPS 330, CPS 360. R: Open only to Computer Science, Computer Engineering, and LBS Computer Science majors.
Machine intelligence. Heuristic programming, representation and control in Lisp and PROLOG. Applications to search, role-based diagnosis, and parsing.

449. **Design of Intelligent Systems (W)**
Spring, 4(2-4)
P: CPS 440; CPS 320 or EE 331. R: Open only to College of Engineering Computer Science seniors and graduate students. Completion of Part I writing requirement. Not open to students with credit in CPS 479.
Intelligent system applications such as natural language, machine vision, or a diagnostic expert system. Development, software engineering, project management.

450. **Translation of Programming Languages**
Spring, 3(3-0)
P: CPS 320, CPS 360; CPS 320 or EE 331. R: Open only to Computer Science, Computer Engineering, and LBS Computer Science majors.

455. **Organization of Programming Languages**
Fall, 3(3-0)
P: CPS 320, CPS 360. R: Open only to Computer Science and LBS Computer Science majors.
Organization of programming languages including language processors, syntax, data types, sequence control, storage management. Comparison of language features from the functional, imperative, logical and object-oriented paradigms.

470. **Software Engineering**
Fall, 4(3-2)
P: CPS 360, CPS 360; CPS 320 or ES 331. R: Open only to College of Engineering Computer Science, Computer Engineering and Lyman Briggs School Computer Science majors.
Software life cycle including specification, design, coding, testing, and verification of a software product. Stepwise refinement and rapid prototyping. Software portability, reliability and maintainability.

472. **Computer Graphics**
Spring, 4(3-2)
P: CPS 350, MTH 314. R: Open only to Computer Science and LBS Computer Science majors.
Graphics hardware. Fundamental algorithms. Two- and three-dimensional imaging geometry and transformations. Curve and surface design, rendering, shading, color, and animation.

474. **Vector and Parallel Programming**
Fall, 4(3-2)
P: CPS 420, MTH 314. R: Open only to Computer Science, Electrical Engineering, Computer Engineering, and LBS Computer Science majors.

479. **Software Tools for Concurrent Systems (W)**
Fall, Spring. 4(3-4)
P: CPS 330, CPS 360; CPS 422 or CPS 474. R: Open only to College of Engineering Computer Science seniors and graduate students. Completion of Tier I writing requirement. Not open to students with credit in CPS 479.
Design, development and application of software tools for parallel and distributed systems. Program development, debugging, performance monitoring, simulation, data and control flow analysis, and visualization.

480. **Database Systems**
Spring, 4(3-3)
P: CPS 330, CPS 360; CPS 320 or ES 331. R: Open only to Computer Science, Computer Engineering, and LBS Computer Science majors.
Storage and access to physical databases including indexing, hashing, and range accesses. Data models, query languages, transaction processing, recovery techniques, Object-oriented and distributed database systems. Database design.

490. **Independent Study in Computer Science**
Fall, Spring. 1 credit. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to Computer Science majors. Approval of department; application required. Supervised individual study in an area of computer science.

491. **Selected Topics in Computer Science**
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to Computer Science majors. Approval of department; application required. Topics selected to supplement and enrich existing courses and lead to the development of new courses.

802. **Pattern Recognition and Analysis**
Spring, 4(4-0)