UC RIVERSIDE

Academic Senate
Professor Kenneth Barish
Division Chair

December 10, 2025

Neftali Watkinson Medina
Lead Proponent, Department of Computer Science and Engineering

Christian Shelton
Chair, Department of Computer Science and Engineering

Vagelis Hristidis
Chair, BCOE Faculty Executive Committee

Re: Bachelor of Science (B.S.) in Computer Science Applications (CSA)

Dear Colleagues,

I write to provide an update regarding the subject degree program proposal. As you may know, the program was approved by the Division at the December 2, 2025 Academic Senate Division meeting. Though the program has been approved by the division, this is not the final step, the curriculum still requires finalization to ensure that all courses receive final approval before the new program is reported to the producers of the catalog.

Best regards,

Ken Barish
Academic Senate Chair

Encl.

Cc: BCOE Dean Lynch
Senate Director Cortez
Senate Analyst Beatty
Student Affairs Manager Smith (BCOE FEC)
Marketing & Communications Manager Salcedo (Catalog)

Proposed New Program: B.S. in Computer Science Applications– 2nd Round

Received 5/13/2025
Academic Senate

To Division
7/16/2025

Approved by the Division
12/2/2025

UC RIVERSIDE

Academic Senate

EXECUTIVE COUNCIL
Kenneth Barish, Chair

July 16, 2025

To: Riverside Division

From: Ken Barish, Chair, Executive Council

Re: **Proposed New Program: B.S. in Computer Science Applications– 2nd Round**

Executive Council, with no additional comments, endorses the proposed new B.S. in Computer Science Applications (2nd Round) program proposal for inclusion on the Fall 2025 Division meeting agenda.

UC RIVERSIDE Academic Senate

COMMITTEE ON COURSES

June 6, 2025

To: Ken Barish, Chair
Riverside Division

From: Erin Rankin, Chair
Committee on Courses

Re: Revised Proposal for a B.S. in Computer Science Applications

The Committee on Courses reviewed the revised proposal for a B.S. in Computer Science Applications at their June 5, 2025 meeting and are appreciative of the revisions made to address the Committee's recommendations. The Committee has no additional concerns and is generally supportive of the proposal.

UC RIVERSIDE Academic Senate

COMMITTEE ON EDUCATIONAL POLICY

June 6, 2025

To: Ken Barish, Chair
Riverside Division

From: Stephen Kane, Vice Chair
Committee on Educational Policy

Re: Revised Proposal for B.S. in Computer Science Applications

The Committee on Educational Policy (CEP) reviewed the revised proposal for a B.S. in Computer Science Applications at their June 6, 2026 meeting and voted to support the proposal. The Committee does recommend that the program consider removing CHEM 008C from the Health Science Concentration as it has content overlap with BCH 100, which is also a requirement for concentration. Alternatively, the Committee recommends that the program consider adding CHEM 008C as an elective.

UC RIVERSIDE
Marlan and Rosemary Bourns College of Engineering

BCOE EXECUTIVE COMMITTEE

June 24, 2025

TO: Ken Barish, Chair
Riverside Division of the Academic Senate

FROM: Victor G. J. Rodgers, Chair
BCOE Executive Committee

RE: Proposed New Program: B.S. in Computer Science Applications

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On June 24, 2025, the BCOE Executive Committee reviewed the Second Round Proposed Changes for a B.S. in Computer Science Applications program (CSA). The committee voted unanimously in favor with a vote of 9 in favor, 0 opposed and 0 abstained.

Proposed Bachelor of Science (B.S.) in Computer Science Applications (CSA)

Record of changes to the proposal for the establishment of the Undergraduate Computer Science Applications program

We appreciate all the suggestions made by each of the relevant committees. The following is a summary of the proposed and the reflected action in this updated proposal.

Committee on Educational Policy (CEP)

The letter from the CEP recommended the following actions:

1. **The Health Science concentration reflects a higher number of required units.** Due to the overlap of major-requirements with BCOE breadth requirements, the final unit count is comparable to the other two concentrations. The attached **4 year plans** for the concentrations show that the total unit count for the Health Concentration is 188, whereas for the Psychology concentration is 189, and for the Business concentration 185.

   All of our students must take one Physics series (most common for BCOE is the PHYS 40 series). Unlike the other two concentrations (Business and Psychology), the Health Science concentration specifies the Physics series that students need to take (PHYS 002A and 02LA, PHYS 002B and 02LB, PHYS 002C and 02LC). BIOL 005A and BIOL 05LA satisfy the Biological Science requirement. CHEM 001A and 001LA, CHEM 001B and 1LB, CHEM 001C and 001LC satisfy the Physical Science requirement. These courses are required for the Health Science concentration because they are part of pre-health requirements. By adding them to our program, students can also get credit for these courses. However, due to the overlap with many of our breadth requirements, the final unit count is comparable to the other two concentrations. Additionally, the Psychology and the Health Science concentrations include a larger number of 5 and 6 unit courses than the Business concentration. If we don't count the courses in the Health Science Concentration that count towards satisfying the Natural Science breadth requirement, **all three concentrations require 12 courses** in addition to the common course load.

   Additionally, PHIL 124 can be used to satisfy one of the Humanities requirements. For the Psychology concentration, PSYCH 001 and 002 satisfy two Social Science requirements, and PSYCH 167 can be used to satisfy the Ethnicity Requirement. For the Business concentration, ECON 002 and 003, and SOC 150 can satisfy all three Social Science requirements. For the Health Science concentration, PSYCH 178 and SOC/PBPL 127 can satisfy two of the Social Sciences breadth requirements. All concentrations satisfy the upper division breadth requirement.

2. **Addition of a proposed 4 year plan.** The 4 year plans for each concentration are being included after this letter.

3. **Consider MATH 005B and MATH 005C as alternatives to MATH 009A, MATH 009B and MATH 009C.** As an Engineering Major, keeping the Math 009 series as the official calculus series is appropriate as it allows students to take other CS and Engineering courses. The CS department is monitoring the Math 5 series and if it decides to allow it for other majors, it would certainly be allowed for CSA. Students can talk to an advisor to have their Math requirements be satisfied by the MATH 005 series.

Committee on Courses

The letter from the Committee on Courses recommend the following actions:

1. **Update the curriculum to reflect that ENGL 001A and ENGL 001B have been renumbered to WRIT 010 and WRIT 020.** We replaced every mention of ENGL 001A and ENGL 001B for WRIT 010 and WRIT 020 respectively in the transfer requirements and updated the 4 year plans to reflect the change. Courses like PSYCH 012 still include ENGL 001B in their pre requirements so we opted for leaving the official course description as it is. We will continue to update the language in the catalog to reflect this change as it makes its way through the catalog and we update the other computing programs.

2. **Include the Honors courses for the MATH 009A-C series, ECON 002, ECON 003, PHYS 002A-C series, CHEM 001A-C series, CHEM 001LA-C series, CHEM 008A-C series, CHEM 008LA-C series, BCH 100, and BCH 110A-C series.** The Honors courses have been added to the requirement list and their descriptions have been included.

3. **Ensure that the full course number is included in the curriculum i.e. PSYC 1 should be listed as PSYC 001.** Mentionings of the wrong code for PSYC 001, PSYC 002, PSYC 011, and PSYC 012 have been fixed.

4. **Remove PSYC 152, PSYC 179, and PSYC 181 from the curriculum as they were discontinued.** These have been removed from the list of technical electives within the Psychology concentration.

5. **Include the cross-listed course for SOC 127, which is PBPL 127.** Added PBPL 127 to the Health Science concentration.

The Committee on Planning and Budget did not find issues that needed to be addressed in the proposal.

Proposed 4 year plan for the Health Science Concentration								
Fall Quarter			**Winter Quarter**			**Spring Quarter**		
Code	Name	Units	Code	Name	Units	Code	Name	Units
				First year				
CS 009A	Data Science programming 1	4	CS 009 B	Data Science programming 2	4	CS 061	Machine org. and assembly language prog.	4
WRIT 010	Academic Writing	4	WRIT 020	Persuasive Writing	4	MATH 009C	First year calculus	4
MATH 009A	First year calculus	4	Math 009B	First year calculus	4	CS/MATH 011	Intro to discrete structures	4
ENGR 001M	Mentoring class	1	Breadth	Humanities or Social Science	4	CS 009C	C++ for programmers	2
				Second year				
CS 010C	Intro to Data Structures and Algorithms	4	CS 100	Software Construction	5	MATH 031	Linear algebra	5
CS 105	Data Analysis Methods	4	Breadth	Humanities or Social Science	4	STAT 155	Probability and Statistics	4
CS 111	Discrete structures	4	BIOL 005A and LA	Intro to Cell and Molecular Biology	5	BIOL 005B	Organismal Biology	4
CHEM 001 A & LA	General Chemistry	5	CHEM 001B & LB	General Chemistry	5	CHEM 001C & LC	General Chemistry	5
				Third year				
CS141	Intermediate data structures and algorithms	4	CS	Tech elective	4	CS153	Operating Systems	4
ENGR 180W	Technical communications	4	ENGR 101M	Mentoring for applied CS	1	Breadth	Humanities or Social Science	4
BIOL 005C	Introductory Evolution and Ecology	4	PHYS 2A & LA	General Physics	5	PHYS 2B & LB	General Physics	5
CHEM 008A & LA	Organic Chemistry	4	CHEM 008B & LB	Organic Chemistry	4	CHEM 008C & LC	Organic Chemistry	4
				Fourth year				
CS178A	Senior Design	4	CS178B	Senior Design	4	CS	Tech elective	4
CS	Tech elective	4	CS	Tech elective	4	CS	Tech elective	4
PHYS 2C & LC	General Physics	5	Breadth	Humanities or Social Science	4	Health	Health Science Elective	4
BCH 100	Introductory Biochemistry	4	Health	Health Science Elective	4	Health	Health Science Elective	4
							Total units	188

Proposed 4 year plan for the Psychology Concentration								
Fall Quarter			**Winter Quarter**			**Spring Quarter**		
Code	Name	Units	Code	Name	Units	Code	Name	Units
First year								
CS 009A	Data Science programming 1	4	CS 009 B	Data Science programming 2	4	CS 061	Machine org. and assembly language prog.	4
WRIT 010	Academic Writing	4	WRIT 020	Persuasive Writing	4	MATH 009C	First year calculus	4
MATH 009A	First year calculus	4	MATH 009B	First year calculus	4	CS/MATH 011	Intro to discrete structures	4
ENGR 001M	Mentoring class	1	Science Breadth	Natural Science	4	CS 009C	C++ for programmers	2
Second year								
CS 010C	Intro to Data Structures and Algorithms	4	STAT 155	Probability and Statistics	4	MATH 031	Linear algebra	5
CS 105	Data Analysis Methods	4	CS 100	Software Construction	5	Breadth	Humanities or Social Science A	4
CS 111	Discrete structures	4	PSYC 002	Introductory Psychology	4	PSYC 011	Research Procedures	5
PSYC 001	Introductory Psychology	4	Breadth	Humanities or Social Science	4	Breadth	Humanities or Social Science	4
Third year								
CS141	Intermediate data structures and algorithms	4	ENGR 101M	Mentoring for applied CS	1	CS153	Operating Systems	4
PSYC 012	Research Procedures	6	PSYC	PSYC Breadth (see 3.1, j)	4	PSYC	Psychology Elective (see 3.1, k)	4
ENGR 180W	Technical communications	4	PSYC	PSYC Breadth (see 3.1, j)	4	PSYC	Psychology Elective (see 3.1, k)	4
Science Breadth	Natural Science	4	Science Breadth	Natural Science	4	Science Breadth	Natural Science	4
Fourth year								
CS178A	Senior Design	4	CS178B	Senior Design	4	CS	Tech elective	4
PSYC	Psychology Elective (see 3.1, k)	4	CS	Tech elective	4	CS	Tech elective	4
CS	Tech elective	4	PSYC	Psychology Elective (see 3.1, k)	4	PSYC	Psychology Elective (see 3.1, k)	4
Breadth	Humanities or Social Science	4	PSYC	Psychology Elective (see 3.1, k)	4	CS	Tech elective	4
							Total units	189

Proposed 4 year plan for the Business Concentration								
Fall Quarter			**Winter Quarter**			**Spring Quarter**		
Code	Name	Units	Code	Name	Units	Code	Name	Units
First year								
CS 009A	Data Science programming 1	4	CS 009 B	Data Science programming 2	4	CS 061	Machine org. and assembly language prog.	4
WRIT 010	Academic Writing	4	WRIT 020	Persuasive Writing	4	MATH 009C	First year calculus	4
MATH 009A	First year calculus	4	MATH 009B	First year calculus	4	CS/MATH 11	Intro to discrete structures	4
ENGR 001M	Mentoring class	1	Science Breadth	Natural Science	4	CS 009C	C++ for programmers	2
Second year								
CS 010C	Intro to Data Structures and Algorithms	4	CS 100	Software Construction	5	MATH 031	Linear algebra	5
CS 105	Data Analysis Methods	4	BUS 010	Introduction to Business	4	STAT 155	Probability and Statistics	4
ECON 003	Intro to Microeconomics	5	ECON 002	Intro to Macroeconomics	5	STAT 008	Statistics for Business	5
CS 111	Discrete structures	4	Breadth	Humanities	4	BUS 020	Financial Accounting and Reporting	4
Third year								
CS141	Intermediate data structures and algorithms	4	CS	Tech elective	4	CS153	Operating Systems	4
BUS	BUS Breadth (see 3.2,o)	4	ENGR 101M	Mentoring for applied CS	1	Breadth	Humanities	4
ENGR 180W	Technical communications	4	BUS	BUS Breadth (see 3.2,o)	4	BUS	Business elective (see 3.2,p)	4
Science Breadth	Natural Science	4	Science Breadth	Natural Science	4	Science Breadth	Natural Science	4
Fourth year								
CS178A	Senior Design	4	CS178B	Senior Design	4	CS	Tech elective	4
BUS	Business elective (see 3.2,p)	4	CS	Tech elective	4	CS	Tech elective	4
CS	Tech elective	4	BUS	Business elective (see 3.2,p)	4	BUS	Business elective (see 3.2,p)	4
Breadth	Humanities	4	BUS	Business elective (see 3.2,p)	4			
							Total units	185

Proposal for Establishment of a New Undergraduate Academic Program: B.S. in Computer Science Applications

1. Name of the academic program and the department or unit that will administer the program

The **Computer Science Applications (CSA)** Undergraduate Major will be administered by the Department of Computer Science and Engineering (CSE).

2. A thorough justification, including the motivation for the creation of the program in terms of student interest and professional or academic importance.

As technology permeates every aspect of life, the need for professionals who can bridge the gap between computing and other disciplines is skyrocketing. A recent analysis of the labor market shows a growing demand for professionals with experience in using computer science across other disciplines. According to the Occupational Outlook Handbook from the Bureau of Labor Statistics, the expected growth in demand in cross-disciplinary computing is 16% for Special Effect Artists and Animators (requiring training in computing and media), 41% for Information Research Scientists (requiring computing and psychology), and 21% for Bioinformatics (requiring computing and life sciences). Additionally, the medical community has highlighted for decades the need to have coding[1] and AI[2] literacy as part of pre-medical training, but very few computing programs include required courses for pre-medical training as part of their curriculum, programs that effectively blend these requirements are non-existent.

In a recent survey of 1000 high school and community college students from California and from key markets (Washington, Oregon, Arizona, among others), students showed great interest in pursuing interdisciplinary majors in computer science. The top 5 single-discipline programs that students are considering in applying are Business, Social Sciences, Life Sciences, Pre-Medical training, and Education. However, when asked if they would consider a combined degree, 56% said they would be interested (compared to only 14% who said they would pursue a CS-only degree). When offered professions that involve multidisciplinary training; Video Game designer, CGI engineering, Information Research, Biomedical Engineering, Prompt Engineering, Tech Media, and Bioinformatics research were among the top choices (40%). This shows that there is a clear demand for programs that provide the training that students identify as necessary for the professions they want to pursue. The results are also consistent with research that shows that

[1] Yardimci, A. (2009). Soft computing in medicine. Applied soft computing, 9(3), 1029-1043.
[2] Kolachalama, V. B. (2022). Machine learning and pre-medical education. Artificial intelligence in medicine, 129, 102313.

high school students want CS programs that are multidisciplinary. For female applicants, lack of cross-disciplinary options is the number one reason for not pursuing computer science[3].

Several Top-20 institutions in Computer Science (according to csrankings.org) are creating majors that effectively blend Computer Science with other disciplines. The University of Illinois Urbana-Champaign, Northeastern University, and UT Austin are some examples of top institutions that have created interdisciplinary computing programs. At the UC level, UCSD, Berkeley, and UCSC offer one or two computing programs that are interdisciplinary (such as the **Interdisciplinary Computing and the Arts** Major from UCSD). But none have created a program like the one we envision, an umbrella program that enables multiple concentrations in different disciplines with a strong core in Computer Science. The challenge is both programmatic and administrative. Based on our research at the UC-level, ours could become a model for other UCs to emulate.

The **Computer Science with Business Applications (CSBA)** major at UCR exemplifies this potential structure and would become a sort of template for new ones. The CSBA major is accredited as a CS program, continues to grow along with the traditional CS program, and serves a more diverse student body (40% women). The program requires at least 71 units in Computer Science courses, and 50 units in Business. It is designed to provide depth in both fields while emphasizing the use of computing in business solutions.

This new major will be called the **Computer Science Applications** major, and would include CSBA as a concentration. We will add two additional concentrations to start: Psychology, and Health Science. These were chosen due to high demand for professionals in these areas, synergy among our faculty, and the potential to attract a gender-balanced student population.

3. Relationship of the new program to existing programs

The design of the major is strongly influenced by the current Computer Science with Business Applications Major (CSBA). We will be folding the CSBA major into this new program as a concentration in Business. By this restructuring, we may add additional programmatic pathways that lead to degrees in computing applied towards other disciplines, i.e., Computer Science Applications with a concentration in [X], where X would include Business, Psychology, and Health Science. The computing community refers to such programs as CS+X[4]. Additionally, the list of courses required for the Business concentration will be refreshed to streamline the student experience and include new courses from Business that are currently not considered in the CSBA program.

While being a computing program, CSA is distinct from the Computer Science undergraduate degree. Certain core requirements endemic to Computer Science are not necessary for CSA

[3] Carter, L. (2006). Why students with an apparent aptitude for computer science don't choose to major in computer science. ACM SIGCSE Bulletin, 38(1), 27-31.

[4] Carla E. Brodley, Benjamin J. Hescott, Jessica Biron, Ali Ressing, Melissa Peiken, Sarah Maravetz, and Alan Mislove. 2022. Broadening Participation in Computing via Ubiquitous Combined Majors (CS+X). In Proceedings of the 53rd ACM Technical Symposium on Computer Science Education - Volume 1 (SIGCSE 2022), Vol. 1. Association for Computing Machinery, New York, NY, USA, 544–550. https://doi.org/10.1145/3478431.3499352

majors. For example, extended series of Math and Physics, up to Math 010A, or specific theory or depth courses for advanced work in CS like CS150, CS152, CS120A. These would not be required for the CSA major. Likewise, CS105: Data Analysis Methods, will be required as it is a key course for engaging with other disciplines and gives students exposure to data analysis tools. The most prominent difference is that at least 50 units of the required courses are from courses offered from a different discipline.

The Data Science program is an interdisciplinary program that is administered by the Computer Science and Statistics departments. Courses are taught by faculty from both departments. While similar in nature to CSA (combining Computer Science with a different discipline), the Data Science program has a heavier emphasis on statistical methods. The courses required for both the computing core and for the concentrations within CSA are different from those required by the Data Science program.

4. The proposed curriculum. Great care should be given in this area, correct rubrics should be listed for courses, all cross listings should be listed, unit total considerations should be taken into account and totals should be verified by program staff, faculty, and appropriate Executive Committee personnel. A copy of the proposed program change should be provided for inclusion in the Catalog.

See “Appendix A: Program Description”

5. A list of faculty who will be involved in the program, including those teaching, advising, and administering.

All Senate faculty members of the CSE department (Assistant, Associate, and Full Professors) will be involved in administering the program. A Faculty Advisor for the program will be appointed and will interface with BCOE staff advisors. All faculty members in CSE, including instructors, will be teaching Computer Science courses in the program. Faculty involved in teaching the courses from other departments will only be involved in teaching those courses. Below is the current list of faculty members of the Computer Science and Engineering department:

Distinguished Professor
Rajiv Gupta, Ph.D.
Tao Jiang, Ph.D.
Eamonn Keogh, Ph.D.
Kadangode K. Ramakrishnan, Ph.D.

Professors
Nael Abu-Ghazaleh, Ph.D.
Philip Brisk, Ph.D.
Zizhong Chen, Ph.D.
Evangelos Christidis, Ph.D.
Marek Chrobak, Ph.D.
Emiliano De Cristofaro, Ph.D.
Michalis Faloutsos, Ph.D.
Trent Jaeger, Ph.D.

Srikanth Krishnamurthy, Ph.D.
Stefano Lonardi, Ph.D.
Walid Najjar, Ph.D.
Chinya Ravishankar, Ph.D.
Christian Shelton, Ph.D.
Manu Sridharan, Ph.D.
Vassilis Tsotras, Ph.D.
Frank N. Vahid, Ph.D.
Heng Yin, Ph.D.

Professors Emeriti

Laxmi N. Bhuyan, Ph.D.
Mart L. Molle, Ph.D.
Thomas H. Payne, Ph.D.
Michael Pazzani, Ph.D.
Teodor C. Przymusinski, Ph.D.
Neal Young, Ph.D.

Associate Professors

Ahmed Eldawy, Ph.D.
Ioannis Karamouzas, Ph.D.
Paea LePendu, Ph.D.
Mohsen Lesani, Ph.D.
Evangelos Papalexakis, Ph.D.
Zhiyun Qian, Ph.D.
Mariam Salloum, Ph.D.
Tamar Shinar, Ph.D.
Chengyu Song, Ph.D.
Greg Ver Steeg, Ph.D.
Zhijia Zhao, Ph.D.

Assistant Professors

Amey Bhangale, Ph.D.
Yue Dong, Ph.D.
Yan Gu, Ph.D.
Allan Knight, Ph.D.
Amr Magdy, Ph.D.
Neftali W. Medina, Ph.D.
Silas Richelson, Ph.D.
Elaheh Sadredini, Ph.D.
Craig Schroeder, Ph.D.
Yihan Sun, Ph.D.
Zhaowei Tan, Ph.D.
Mingxun Wang, Ph.D.
Qian Zhang, Ph.D.

6. For interdisciplinary programs, the degree of participation and the role of each department must be explicitly described. The chairs of all participating departments must provide written approval for the creation of the program and indicate their commitment to provide necessary resources including faculty release.

This is not an interdepartmental program in the sense that it does not span, administratively, more than one department. The program will be administered by the CSE department, which teaches the majority of the courses, and admission will be through the College of Engineering. Faculty from other departments are not part of this program's administration.

Letters from all relevant departments (Psychology, Business, Biology, Mathematics, Chemistry, Physics, Biochemistry, Statistics, Public Policy, and Sociology) stating that they agree for our students to take their courses are included.

7. Projected enrollment in the program.

The projected enrollment at the start of the program is 50 students; we expect a class of 80-100 students at steady state. This will include students across all concentrations. Currently CSBA, one of the concentrations, has graduated on average 48 students annually over the last five years.

8. Name of degree, if applicable, and the anticipated number of degrees to be granted when the program reaches steady state

B.S. In Computer Science Applications with Concentration in [X], 80-100 degrees awarded per year.

9. Potential impact of the new program on existing programs. If the proposed program includes required courses from a department other than the administering department, the proposal must include a statement from the department indicating that it has been consulted and that it will provide access to the required courses.

The new major uses five existing lower division courses offered by the Department of Mathematics (namely: MATH 009A, MATH 009B, MATH 009C, MATH 011/CS 011, MATH 031). All these courses are currently being used by CSBA, CSE, and Statistics for satisfying college/major requirements in the BS degrees offered currently by the CSE and Statistics departments. Given that these courses are also being used by many other departments to satisfy college requirements, we do not expect a major impact in their offerings by the new program.

All other lower and upper division courses required for the new major are currently being taught by the Psychology and Business departments.The Health Science concentration lists courses that are offered by various departments and are part of the list of pre required courses for Health Professions. Chairs of the involved departments have been consulted and have agreed to provide access to the required course sequences (please see included letters from relevant departments).

10. A full listing of resources required for start-up and for operations. In cases where no additional resources will be needed, this must be explicitly stated. This listing may include: personnel (faculty FTE or temporary positions, Teaching Assistants or Readers, administrative staff, technical support); support services including computer facilities and library resources; space requirements. A plan indicating how the resources will be obtained would also be helpful to the committee in reviewing the proposal. A letter of support from the College Dean and/or Executive Vice Chancellor-Provost indicating endorsement as well as a promise of support for the proposal also would be extremely helpful.

- Faculty FTE: the program will use existing faculty from the CSE department.
- Teaching assistants: We estimate that, at full capacity, the new program will need 2-3 TA positions per quarter (this is considering a full capacity of 80 students which translates to 30 students above what CSBA currently has). Such cost, however, will be easily covered by the tuition fees of the new students.
- Administrative Staff: the program will be administered by existing staff and faculty in the CSE Department and will be advised by BCOE's Office of Undergraduate Student Academic Affairs (OSAA). OSAA currently has ten full time advisors that will initially accommodate the CSA students. We don't foresee any need for additional advisors.
- Computer facilities and library resources: no new facilities required
- Space requirements: no new space requirements, growth will be part of the existing CSE department expansion plans

Please see the included letter from BCOE's Dean, Christopher S. Lynch.

11. Both internal and external letters of support should be provided with the proposal. Internal letters of support are often from UCR department chairs and faculty of related programs. The external letters should be from other UC campuses or other peer institutions. Letters from off-campus help to establish the quality of the program and its fit within the context of related programs at other universities. Upon consultation with the CEP the demand for external letters may be waived.

We have included the following letters of support:

- A letter from Christian Shelton (Chair of UCR's Department of Computer Science and Engineering), alongside the record of our department's vote, and the official feedback from our Advisory Board denoting strong support for the program.
- Tuppett M Yates (Department of Psychology's Chair), where she expresses both consent and support for the Psychology concentration.
- Margaret C. Campbell (Chair and Associate Dean of the School of Business) to show continuing support of the Business concentration.

- Charles P Scruggs (Director of the UCR Pre-Professional Advising Center) denoting strong support for the Health Science concentration
- Daryle Williams (Dean of the College of Humanities, Arts, and Social Sciences) supporting the Psychology concentration
- Tony Givargis (Chair of the Department of Computer Science at UC Irvine) as external letter of support for the whole program.
- Dr. Victor Joe (Vice President of UCI Health Medical Staff and Clinical Professor of Surgery at UC Irvine), as external letter of support for the Health Science concentration
- Carla Brodley (Professor, Khoury College of Computer Sciences andDean of Inclusive Computing at Northeastern University) as external letter of support for the whole program.

12. Approvals from program faculty, College faculty (if the new proposal affects a college regulation), and the appropriate Executive Committee should be obtained before forwarding the new program to the attention of the Senate Analyst for CEP.

- The Computer Science and Engineering Department voted in favor of the proposal on January 22nd, 2025 (see included record of this vote).
- The program doesn't affect a college regulation
- The BCOE Executive Committee discussed and voted in favor of the proposal on February 26th, 2025

13. All proposals for new programs should be submitted to the Senate Chair no later than March 1 of the academic year prior to the fall quarter in which the proposed program is anticipated to go into effect. This schedule should provide sufficient time for Senate review of the proposal to meet the deadline for final consideration of approval at the May Division Meeting.

Appendix A: Program Description

The **Computer Science Applications program** covers the core of computer science and integrates a second discipline as a concentration area. It prepares students for careers that demand multidisciplinary backgrounds with an emphasis on computational methods, or for graduate studies in either discipline.

The objective of the B.S. degree program in **Computer Science Applications** is to prepare graduates for professional practice in both the private and public sectors and for lifelong learning, including the option to pursue graduate degrees, by providing them with:

- Background: The necessary technical competencies, including knowledge of scientific principles and skill at rigorous analysis and creative design.
- Breadth: A broad education that includes knowledge of current issues and trends in society and technology.
- Professionalism: Professional attitudes and ethics, as well as skills for clear communication and responsible teamwork.
- Learning environment: A learning environment that is rigorous, challenging, open, and supportive.

Change of Major Criteria

All students who request a change of major to Computer Science Applications must meet the following requirements:

- Be in good academic standing.
- Have no less than a C- in any Math, Science, or Engineering coursework.
- Be able to complete the major within maximum allowable units.
- Complete all the courses listed below, based on the total number of units earned, prior to submitting the major change request.
- UCR transfer students interested in changing to a BCOE major must have been admissible to the major at the point of entry or must satisfy transfer admission and change of major requirements before earning 120 units.
- If changing in the 90-119 units category, students must have the ability to complete the major within 5 years of entry as a freshmen or 3 years after entry as a transfer student.
- Students who have earned 120 or more units are not eligible for a change of major in BCOE. NOTE: AP/IB units are excluded from the maximum unit calculation.

Completed 0 to less than 45 units

Completion of WRIT 010 with a grade of C or better, a grade of C or better in CS 009A, and completion of the following with at least a 2.700 GPA:

- CS 009A
- CS 009B
- MATH 009A or MATH 09HA
- Any additional Math/Science/Engineering/CS courses (if taken)

Completed 45 to less than 90 units

Completion of WRIT 010 with a grade of C or better, a grade of C or better in both CS 009A and CS 009B, and completion of the following with at least a 2.700 GPA:

- CS 009A
- CS 009B
- MATH 011/CS 011
- MATH 009A or MATH 09HA
- MATH 009B or MATH 09HB
- MATH 009C or MATH 09HC
- And any additional Math/Science/Engineering/CS courses (if taken)

Completed 90 to less than 120 units

Completion of WRIT 010 and WRIT 020 with a grade of C or better, a grade of C or better in both CS 009A and CS 009B, and completion of the following with at least a 2.700 GPA:

- CS 009A
- CS 009B
- MATH 011/CS 011
- CS 061
- MATH 009A or MATH 09HA
- MATH 009B or MATH 09HB
- MATH 009C or MATH 09HC
- And any additional Math/Science/Engineering/CS courses (if taken)

University Requirements

See the Undergraduate Studies section.

College Requirements

See the Marlan and Rosemary Bourns College of Engineering, Colleges and Programs section.

The Computer Science Applications major uses the following major requirements to satisfy some of the college's Natural Sciences and Mathematics breadth requirements and one of the college's English Composition breadth requirements:

1. MATH 007A or MATH 009A or MATH 009AH
2. ENGR 180W

Major Requirements

The **Computer Science Applications** major has two sets of requirements: a core set and a concentration set. Courses required by a concentration may also be used to satisfy breadth requirements.

Core requirements

1. Lower-division requirements (38 units)
    a. ENGR 001M
    b. CS 009A and CS 009B and CS 009C

c. CS 010C, CS 061
d. CS 011/MATH 011
e. MATH 009A or MATH 09HA; MATH 009B or MATH 09HB; MATH 009C or MATH 09HC; and either MATH 031 or EE 020B

2. Upper-division requirements (58 units)
   a. ENGR 101M
   b. CS100, CS 111, CS141, CS153
   c. ENGR 180W
   d. STAT 155 or STAT 156A or STAT 160
   e. CS 105
   f. CS 178A, CS 178B
   g. At least twenty (20) units of Computer Science technical electives to be chosen from an approved list of courses which currently includes CS 108, CS110, CS 120A, CS 120B, CS 122A, CS 122B, CS 130, CS131, CS 133, CS 135, CS 142, CS 144, CS 145, CS/EE 147, CS 150, CS 152, CS 160, CS 161, CS 162, CS 164, CS 165, CS 166, CS 167, CS/EE 168, CS 169, CS 170, CS 171, EE 142, CS 172, CS 173, CS 175, CS 177, CS 179 (E-Z) (4 units maximum), CS 180, CS 181, CS 182, CS 183, CS 193 (4 units maximum), MATH 120, MATH 126, MATH 135A, MATH 135B, PHIL 124.

      The technical electives selected for 2.g) must be distinct from those used to satisfy the requirements specified in 2.a)–f) above with at least 16 units selected from Computer Science courses.

Concentration (at least 50 units)
Students in the **Computer Science Applications (CSA)** must declare a concentration upon admission to the program. A change in concentration, if justified, should be made at least three quarters prior to graduation.

3.1. Psychology (51 units)
   h. PSYC 001, PSYC 002
   i. PSYC 011, PSYC 012
   j. At least two courses from CBNS 106 or PSYC 110, PSYC 132 or 134, PSYC 140, PSYC 150, PSYC 160 or PSYC 161 or PSYC 162 or PSYC 163
   k. At least twenty four (24) units of Psychology technical electives to be chosen from an approved list of courses which currently includes PSYC 109, PSYC 112, PSYC 113, PSYC 115, PSYC 117, PSYC 120, PSYC 121, PSYC 122, PSYC 126, PSYC 128, PSYC 129, PSYC 130, PSYC131, PSYC 132, PSYC 133, PSYC 134, PSYC 135, PSYC 140, PSYC 142, PSYC 148, PSYC 149, PSYC 153, PSYC 155, PSYC 160, PSYC 161, PSYC 162, PSYC 163, PSYC 164, PSYC 165A, PSYC 165B, PSYC 166A, PSYC 166B, PSYC 166C, PSYC 166D, PSYC 167, PSYC 168, PSYC 169, PSYC 171, PSYC 175, PSYC 178

      The technical electives selected for 3.1.d) must be distinct from those used to

satisfy the requirements specified in 3.a)–c) above.

3.2. Business (50 units)

l. BUS 010, BUS 020
m. ECON 002 or ECON 002H; ECON 003 or ECON 003H
n. One course of 4 or more units from STAT 008, STAT 010, ECON 101
o. At least two courses from BUS 102, BUS 103, BUS 104, BUS 105, BUS 106, BUS 107, BUS 109
p. At least twenty (20) units of Business technical electives to be chosen from an approved list of courses which currently includes BUS 102, BUS 103, BUS 104, BUS 105, BUS 106, BUS 107, BUS 108, BUS 109, BUS 110, BUS 115, BUS 119, BUS 123, BUS 124A, BUS 124B, BUS 125, BUS 128, BUS 129, BUS 130, BUS 163, BUS 166, BUS 171, BUS 172, BUS 173, BUS 174, BUS175, BUS 179, SOC 150. Additionally, no credit will be given for BUS 101; and the following pairs of courses cannot both be taken for credit: BUS 125 and CS 177, BUS 163 and CS 175, BUS 171 and CS 180, BUS 173 and CS 166, BUS 175 and CS 164.

   The technical electives selected for 3.2.e) must be distinct from those used to satisfy the requirements specified in 3.2.a)–d) above.

3.3 Health Science (71 units)

q. PHYS 002A or PHYS 002HA; PHYS 02LA or PHYS 02HLA; PHYS 002B or PHYS 02HB; PHYS 02LB or PHYS 02HLB; PHYS 002C or PHYS 002HC; PHYS 02LC or PHYS 02HLC
r. CHEM 001A or CHEM 01HA; CHEM 01LA or CHEM 1HLA; CHEM 001B or CHEM 01HB; CHEM 01LB or CHEM 1HLB; CHEM 001C or CHEM 01HC; CHEM 01LC or CHEM 1HLC
s. CHEM 008A or CHEM 08HA; CHEM 08LA or CHEM 08HLA; CHEM 008B or CHEM 08HB; CHEM 08LB or CHEM 08HLB; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC
t. BIOL 005A and BIOL 005LA, BIOL 005B, BIOL 005C
u. BCH 100 or BCH 100H or BCH 110 A or BCH110HA
v. At least three courses from BIOL 102, BIOL 107A, BIOL 110, BIOL 121/L, BIOL 128, BIOL 161 A, BIOL 161B, BIOL 171A, BIOL 171B, SOC 127 or PBPL 127, SOC 167, PSYC 160, PSYC 178, BCH 110B or BCH110HB, BCH 110C or BCH 110HC, PBPL 160, PBPL 162.

Course Descriptions:

CS 009A Data Oriented Introduction to Computing I (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): MATH 004, may be taken concurrently or MATH 005A, may be taken concurrently or MATH 006A, may be taken concurrently or MATH 006B, may be taken concurrently or MATH 007A, may be taken concurrently or MATH 009A, may be taken concurrently or MATH 09HA, may be taken concurrently. Covers computational thinking, problem-solving, and data analysis using the Python language through application-based data manipulation tasks from science, engineering, business, and the humanities. Includes variables, expressions, branches, loops, functions, parameters, lists, strings, file I/O, and exception handling. Also covers software design, testing, and debugging. Credit is awarded for one of the following CS 009A or CS 010A.

CS 009B Data Oriented Introduction to Computing II (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 009A; or equivalent. Covers advanced programming concepts and algorithms through application-based data manipulation tasks from science, engineering, business, and the humanities. Emphasizes good programming principles in the design and development of substantial programs using the Python language. Topics include abstract data types, objects and classes, recursion, and basic software engineering principles. Credit is awarded for one of the following CS 009B or CS 010B.

CS 009C C++ For Programmers (2) Lecture, 1 hour; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 009B, may be taken concurrently; MATH 006B, may be taken concurrently or MATH 007A, may be taken concurrently or MATH 005A, may be taken concurrently or MATH 004, may be taken concurrently or MATH 009A, may be taken concurrently or MATH 09HA, may be taken concurrently. Introduces the constructs provided in the C++ programming language for procedural and object-oriented programming. For those with prior programming experience.

CS 010A Introduction to Computer Science For Science, Mathematics, and Engineering I (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): MATH 004, may be taken concurrently or MATH 005A, may be taken concurrently or MATH 006A, may be taken concurrently or MATH 006B, may be taken concurrently or MATH 007A, may be taken concurrently or MATH 009A, may be taken concurrently or MATH 09HA. Covers problem solving through structured programming of algorithms on computers using the C++ object-oriented language. Includes variables, expressions, input/output (I/O), branches, loops, functions, parameters, arrays, strings, file I/O, and classes. Also covers software design, testing, and debugging. Credit is awarded for one of the following CS 010A or CS 009A. Credit is not awarded for CS 005 or CS 008 if it has already been awarded for CS 010A.

CS 010B Introduction to Computer Science For Science, Mathematics, and Engineering II (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 010A with a grade of C- or better; familiarity with C or C++ language. Covers structured and object-oriented programming in C++. Emphasizes good programming principles and development of substantial programs. Topics include recursion, pointers, linked lists, abstract data types, and libraries. Also covers software engineering principles. Credit is awarded for one of the following CS 010B or CS 009B.

CS 010C Introduction to Data Structures and Algorithms (4) Lecture, 3 hours; laboratory, 3

hours. Prerequisite(s): CS 010B with a grade of C- or better or CS 009C with a grade of C- or better; proficiency in C++. Topics include basic data structures such as arrays, lists, stacks, and queues. Covers dictionaries (including binary search trees and hashing) and priority queues (heaps). Offers an introductory analysis of algorithms, sorting algorithms, and object-oriented programming including abstract data types, inheritance, and polymorphism. Explores solving complex problems through structured software development.

MATH/CS 011 Introduction to Discrete Structures (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010A or MATH 005C or MATH 007B or MATH 009B or MATH 09HB. Introduction to basic concepts of discrete mathematics emphasizing applications to computer science. Topics include propositional and predicate calculi, elementary set theory, functions, relations, proof techniques, elements of number theory, enumeration, and discrete probability. Cross-listed with CS 011. Cross-listed with CS 011.

CS 061 Machine Organization and Assembly Language Programming (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 010A with a grade of C- or better. An introduction to computer organization. Topics include number representation, combinational and sequential logic, computer instructions, memory organization, addressing modes, interrupt, input/output (I/O), assembly language programming, assemblers, and linkers.

Upper-Division Courses

CS 100 Software Construction (5) Lecture, 3 hours; laboratory, 2 hours; discussion, 1 hour; individual study, 1 hour. Prerequisite(s): CS 010C with a grade of C- or better. Emphasizes development of software systems. Topics include design and implementation strategies and selection and mastery of programming languages, environment tools, and development processes. Develops skill in programming, testing, debugging, performance evaluation, component integration, maintenance, and documentation. Covers professional and ethical responsibilities and the need to stay current with technology.

CS 105 Data Analysis Methods (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 009B with a grade of C- or better or CS 010B with a grade of C- or better; restricted to class level standing of sophomore, junior, senior, or masters. An introduction to fundamental concepts and methods in data analysis and visualization essential to a variety of data science tasks. Designed to provide preparation for the data science major and for advanced courses in data analysis and applications of data science.

CS 108 Data Science Ethics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 105 or STAT 107 or CS 171; or consent of instructor. Covers ethics specifically related to data science. Topics include data privacy; data curation and storage; discrimination and bias arising in the machine learning process; statistical topics such as generalization, causality, curse of dimensionality, and sampling bias; data communication; and strategies for conceptualizing, measuring, and mitigating problems in data-driven decision-making. Cross-listed with STAT 108. Credit is awarded for one of the following CS 108, STAT 108, CS 212, or STAT 212.

CS 110 Principles of Web Development (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100. Provides an introduction to distributed systems, with a focus on web development techniques and the considerations to application scalability, security, reliability, and redundancy. Provides an in-depth study of technologies used for both back-end and front-end development, and how to design robust applications in the webs constantly evolving landscape.

CS 111 Discrete Structures (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010A; CS 011 or MATH 011; MATH 009C or MATH 09HC; MATH 031 or EE 020B. A study of discrete mathematical structures emphasizing applications to computer science. Topics include number theory and cryptography, asymptotic notation, recurrence equations, counting methods, elements of graph theory, and trees.

CS 119L Laboratory in Problem Solving and Programming (2) Laboratory, 3 hours; individual study, 3 hours. Prerequisite(s): CS 010C with a grade of C- or better; CS 111 recommended; or consent of instructor. Explores techniques and skills applicable in developing software solutions to real-life algorithmic problems. Emphasizes systematic and rigorous approaches to problem-solving. Covers the end-to-end solution process including formulating models, choosing appropriate algorithmic tools and data structures, designing algorithms, implementation, and testing. Course is repeatable to a maximum of 4 units.

CS 120A Logic Design (5) Lecture, 3 hours; laboratory, 3 hours; individual study, 3 hours. Prerequisite(s): CS 061 with a grade of C- or better. Covers design of digital systems. Includes Boolean algebra; combinational and sequential logic design; design and use of arithmetic logic units, carry-lookahead adders, multiplexors, decoders, comparators, multipliers, flip-flops, registers, and simple memories; state-machine design; and basic register-transfer level design. Uses hardware description languages, synthesis tools, programmable logic, and significant hardware prototyping. Cross-listed with EE 120A.

CS 120B Introduction to Embedded Systems (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010B; CS 120A or EE 120A. Introduction to hardware and software design of digital computing systems embedded in electronic devices (e.g., digital cameras or portable video games). Includes embedded processor programming, custom processor design, standard peripherals, memories, interfacing, and hardware/software tradeoffs. Involves use of synthesis tools, programmable logic, microcontrollers, and developing working embedded systems. Cross-listed with EE 120B.

CS 122A Intermediate Embedded and Real-Time Systems (5) Lecture, 3 hours; laboratory, 6 hours. Prerequisite(s): CS 010B; CS 120B or EE 120B. Covers software and hardware design of embedded computing systems. Includes hardware and software codesign, advanced programming paradigms (including state machines and concurrent processes), real-time programming, operating systems, basic control systems, modern chip, and design technologies. Laboratories involve use of microcontrollers, embedded microprocessors, programmable logic, advanced simulation, and debug environments.

CS 122B Advanced Embedded and Real-Time Systems (5) Lecture, 3 hours; laboratory, 6 hours. Prerequisite(s): CS 122A. Explores state-of-the-art aspects of building embedded computer systems. Topics include real-time programming, synthesis of coprocessor cores, application-specific processors, hardware and software co simulation and codesign, low-power design, reconfigurable computing, core-based design, and platform-based methodology.

CS 130 Computer Graphics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100; MATH 031, may be taken concurrently or EE 020B, may be taken concurrently; or consent of instructor. A study of the fundamentals of computer graphics necessary to design and build graphics applications. Examines raster graphics algorithms including scan-converting graphics primitives, anti-aliasing, and clipping. Also covers geometric transformations, viewing, solid modeling techniques, hidden-surface removal algorithms, color models, illumination, and

shading.

CS 131 Edge Computing (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100 or EE 120B or CS 120B. Covers industry standards for quality of service and security while leveraging performance constraints. Develops skill in deploying real-world applications using embedded artificial intelligence. Cross-listed with EE 131.

CS 133 Computational Geometry (4) Lecture, 3 hours; laboratory, 1 hour; individual study, 2 hours. Prerequisite(s): CS 100, CS 111, MATH 031; or equivalents. An introduction to the design of geometry algorithms. Covers the basic computational geometry concepts and techniques used in graphics, robotics, and engineering design. Topics include polygons and polytopes, convex hulls, and voronoi diagrams.

CS 135 Virtual Reality (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): CS 100. Covers the development of virtual reality (VR) worlds, including motion and physics of VR worlds. Includes design practices for immersive experiences, human visual perception, environmental and social interactions. Also includes positional tracking with sensors, augmented and mixed reality, and storage and transmission of virtual reality worlds.

CS 141 Intermediate Data Structures and Algorithms (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010C with a grade of C- or better; CS 111; MATH 009C or MATH 09HC; proficiency in C++. Explores basic algorithm analysis using asymptotic notations, summation and recurrence relations, and algorithms and data structures for discrete structures including trees, strings, and graphs. Also covers general algorithm design techniques including “divide-and-conquer,” the greedy method, and dynamic programming. Integrates knowledge of data structures, algorithms, and programming.

CS 142 Algorithm Engineering (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100, CS 141; or equivalent. Covers the design and implementation of sequential, parallel, cache-efficient, external-memory, and write-efficient algorithms for fundamental computational problems including sorting, searching, as well as a selection of problems in algebra, geometry, combinatorial optimization, and string processing. Emphasizes practical aspects of algorithm design, efficient implementation, and experimental methodology for performance evaluation.

CS 144 Algorithms For Bioinformatics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 141. Introduces fundamental algorithms and data structures for solving analytical problems in molecular biology and genomics. Includes exact and approximate string matching; sequence alignment; genome assembly; and gene and regulatory motifs recognition. Credit is awarded for one of the following CS 144, CS 234, or CS 238.

CS 145 Combinatorial Optimization Algorithms (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 141; MATH 031 or MATH 131. The study of efficient algorithm design techniques for combinatorial optimization problems. Topics include shortest paths, minimum spanning trees, network flows, maximum matchings, stable matchings, linear programming, duality, two-person games, algorithmic techniques for integer programming problems, NP-completeness, and approximation algorithms.

CS 147 Graphics Processing Unit Computing and Programming (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): EE 120B or CS 120B. Introduces principles and practices of programming graphics processing units (GPUs) using the parallel programming environment. Covers memory/threading models, common data-parallel programming patterns and libraries

needed to develop high-performance parallel computing applications. Examines computational thinking; a broader range of parallel execution models; and parallel programming principles. Cross-listed with EE 147.

CS 150 Automata and Formal Languages (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010C with a grade of C- or better; CS 111; MATH 009C or MATH 09HC. A study of formal languages. Includes regular and context-free languages; computational models for generating these languages such as finite-state automata, pushdown automata, regular expressions, and context-free grammars; mathematical properties of the languages and models; and equivalence between the models. Also introduces Turing machines and decidability.

CS 152 Compiler Design (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 061; CS 100; CS 111; CS 150. Covers the fundamentals of compiler design. Includes lexical analysis, parsing, semantic analysis, compile-time memory organization, run-time memory organization, code generation, and compiler portability issues.

CS 153 Design of Operating Systems (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 061; CS 100; CS 111; C++ programming proficiency. Covers the principles and practice of operating system design. Includes concurrency, memory management, file systems, protection, security, command languages, scheduling, and system performance.

CS 160 Concurrent Programming and Parallel Systems (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 061; CS 100; CS 111. A study of concurrent and parallel systems. Topics include modular structure and design, interprocess communication, synchronization, failures, persistence, and concurrency control. Also covers atomic transactions, recovery, language support, distributed interprocess communication, and implementation mechanisms. Provides preparation for the study of operating systems, databases, and computer networking.

CS 161 Design and Architecture of Computer Systems (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): EE 120A or CS 120A. A study of the fundamentals of computer design. Topics include the performance evaluation of microprocessors; instruction set design and measurements of use; microprocessor implementation techniques including multicycle and pipelined implementations; computer arithmetic; memory hierarchy; and input/output (I/O) systems.

CS 161L Laboratory in Design and Architecture of Computer Systems (2) Lecture, 1 hour; laboratory, 3 hours. Prerequisite(s): CS 161 (may be taken concurrently). Covers the design and simulation of a complete computer system using hardware description language and simulator. Topics include instruction set architecture design; assemblers; datapath and control unit design; arithmetic and logic unit; memory and input/output (I/O) systems; and integration of all parts into a working computer system.

CS 162 Computer Architecture (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): CS 161 with a grade of “C-” or better. The study of advanced processor design. Topics include CPU pipelining, data and control hazards, instruction-level parallelism, branch prediction, and dynamic scheduling of instructions. Also covers Very Long Instruction Word (VLIW) processing, multimedia support, design of network and embedded processors, basic multiprocessor design, shared memory and message passing, and network topologies.

CS 164 Computer Networks (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour.

Prerequisite(s): CS 100; CS 111; CS 153. Covers the fundamentals of computer networks. Topics include layered network architecture, communication protocols, local area networks, UNIX network programming, verification, network security, and performance studies.

CS 165 Computer Security (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): CS 141, CS 153. Examines the ways in which information systems are vulnerable to security breaches. Topics include attacks; security labels, lattices, and policies; safeguards and countermeasures; intrusion detection; authorization and encryption techniques; networks; digital signatures, certificates, and passwords; privacy issues, firewalls, and spoofing; Trojan horses and computer viruses; CERT Coordination Center; and electronic commerce.

CS 166 Database Management Systems (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100; CS 111. Covers basic concepts of databases and database management systems. Topics include entity-relationship modeling for design, relational data model, relational algebra, Structured Query Language (SQL), secondary storage, indexing and hashing, query evaluation and optimization, and overview of transactions.

CS 167 Introduction to Big-Data Management (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100, CS 111; CS 167 online section: enrollment in the online Master-of-Science in Engineering program. Introduces the architecture of big-data systems and their applications in data management and processing. Describes the common functionality in big-data processing such as distributed storage, resource management, query processing, fault-tolerance, and programming APIs. Covers the popular big-data technologies such as distributed shared-nothing systems, NoSQL processing model, and semi-structured data management.

CS 168 Introduction to Very Large Scale Integration Design (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): CS 120A or EE 120A; or consent of instructor. Studies integrated circuit fabrication, device characterization, and circuit simulation. Introduces basic device physics and physical design rules, MOS logic design, and timing and clock schemes. Covers layout generation, subsystem designs, and circuits for alternative logic styles. Also covers design and simulation using hardware description language and CAD tools. Cross-listed with EE 168. Credit is awarded for one of the following EE 168, CS 168, or EE 282A.

CS 169 Mobile Wireless Networks (4) Lecture, 3 hours; laboratory, 2 hours; extra reading, 1 hour. Prerequisite(s): CS 153 or consent of instructor. Introduces the fundamentals of wireless and mobile networks. Covers wireless channel models, MAC protocols, and wireless network architectures. Also covers cellular, WLAN and ad hoc networks, and routing in multi-hop wireless networks. Includes wireless security and the impact of wireless links on TCP and other transport layer solutions.

CS 170 Introduction to Artificial Intelligence (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100 with a grade of “C-” or better, CS 111. An introduction to the field of artificial intelligence. Focuses on discrete-valued problems. Covers heuristic search, problem representation, and classical planning. Also covers constraint satisfaction and logical inference.

CS 171 Introduction to Machine Learning and Data Mining (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 010A; MATH 031 or EE 020B; STAT 155 or EE 114 or STAT 156A; CS 100 or EE 016. Introduces formalisms and methods in data mining and machine learning. Topics include data representation, supervised learning, and classification. Covers regression and clustering. Also covers rule learning, function approximation, and margin-based

methods. Cross-listed with EE 142.

CS 172 Introduction to Information Retrieval (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100; CS 111; EE 114 or STAT 155. Introduces information retrieval (IR) principles and techniques for indexing and searching document collections. Topics include Web search, text processing, ranking algorithms, search in social networks, and search evaluation. Also studies scalability issues in search engines. Satisfactory (S) or No Credit (NC) grading is not available.

CS 173 Introduction to Natural Language Processing (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100; CS 111; EE 114 or STAT 155. An overview of modern approaches for natural language processing. Focuses on major algorithms used in NLP for various applications such as part-of-speech tagging, parsing, named entity recognition, coreference resolution, sentiment analysis, and machine translation.

CS 175 Entrepreneurship in Computing (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100; restricted to class level standing of junior, or senior. Introduces business and technological concepts to create companies based on computer technology. Covers technical aspects of real-world IT projects. Includes developing software and services; understanding user requirements; designating usable systems; and assessing technology. Addresses market analysis and strategy; legal and intellectual property; ethics and communication issues; and financial analysis.

CS 177 Modeling and Simulation (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100; CS 111; C++ programming proficiency. Covers validation of random number sequences; concepts in modeling and systems analysis; and conceptual models and their mathematical and computer realizations. Examines simulation modeling techniques including object-oriented modeling and discrete-event modeling. Emphasizes the use of simulation libraries used with programming languages such as C++.

CS 178A Project Sequence in Computer Science and Engineering (4) Lecture, 1 hour; laboratory, 2 hours; individual study, 1 hour; practicum, 6 hours. Prerequisite(s): CS 141, ENGR 180W; restricted to class level standing of senior. Incorporates the proposal, design, building, testing, and documenting of software and hardware devices or systems under the direction of a faculty member. Emphasizes professional and ethical responsibilities and the need to stay current on technology and its global impact on economics, society, and the environment. Completed together, CS 178A and CS 178B may be applied as a substitute for the CS 179 (E-Z) CS major requirement. Graded In Progress (IP) until CS 178A and CS 178B are completed, at which time, a final letter grade is assigned.

CS 178B Project Sequence in Computer Science and Engineering (4) Lecture, 1 hour; laboratory, 2 hours; individual study, 1 hour; practicum, 6 hours. Prerequisite(s): CS 178A; restricted to class level standing of senior. Incorporates the proposal, design, building, testing, and documenting of software and hardware devices or systems under the direction of a faculty member. Emphasizes professional and ethical responsibilities and the need to stay current on technology and its global impact on economics, society, and the environment.

CS 179 (E-Z) Project in Computer Science (4) Prerequisite(s): CS 100 with a grade of C- or better; CS 152 with a grade of C- or better; ENGR 180W. For hours and prerequisites, see segment descriptions. Under the direction of a faculty member, student teams propose, design, build, test, and document software and/or hardware devices or systems. Emphasizes

professional and ethical responsibilities and the need to stay current on technology and its global impact on economics, society, and the environment.

CS 179E Project in Computer Science: Compilers (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100 and CS 152 with grades of "C-" or better; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a compiler-related system. Incorporates techniques from previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

C**S 179F Project in Computer Science: Operating Systems (4)** Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 153 with a grade of "C-" or better; ENGR 180W; 8 additional upper-division units in Computer Science. CS 160 is recommended. Covers the planning, design, implementation, testing, and documentation of an operating systems-related system. Incorporates techniques from previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179G Project in Computer Science: Database Systems (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100 with a grade of C- or better; CS 166 with a grade of C- or better or CS 167 with a grade of C- or better, ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a database-related system. Incorporates techniques from previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179I Project in Computer Science: Networks (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100 and CS 164 with grades of "C-" or better; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a network-related system. Incorporates techniques from previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179J Project in Computer Science: Computer Architecture and Embedded Systems (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100, CS 111, CS 120B/EE 120B, and CS 161 with grades of "C-" or better or consent of instructor; ENGR 180W; 3 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a computer architecture and embedded systems-related system. Incorporates using techniques presented in previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179K Project in Computer Science: Software Engineering (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 180; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a software engineering-related system. Incorporates techniques presented in previous related courses. Emphasizes professional and

ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179M Project in Computer Science: Artificial Intelligence (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100, CS 111, and CS 170 with grades of "C-" or better; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of an artificial intelligence-related system. Incorporates techniques presented in previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

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CS 179N Project in Computer Science: Graphics and Electronic Games (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 130 with a grade of C- or better; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a graphics or electronic game-related system. Incorporates using techniques presented in previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 180 Introduction to Software Engineering (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100. A study of software engineering techniques for the development, maintenance, and evolution of large software systems. Topics include requirements and specification; system design and implementation; debugging, testing, and quality assurance; reengineering; project management; software process; tools; and environments.

CS 181 Principles of Programming Languages (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 061; CS 100; CS 111; CS 150. Covers the principles of programming language design. Includes the study and comparison of several programming languages, their features, and their implementations.

CS 182 Software Testing and Verification (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100. A study of modern techniques to assess the quality of software artifacts through functional, performance, and reliability testing. Introduces black box and white box testing techniques. Covers the application of modern testing tools to software units, components, subsystems, and entire systems. Also covers verification as a complementary technique to testing.

CS 183 Unix System Administration (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100. Explores the technical aspects of system administration on a Unix system including advanced Unix. Includes managing system devices, operating system installation, communications, and networking.

CS 193 Design Project (1 to 4) Laboratory, 1 to 6 hours; scheduled research, 1 to 3 hours; individual study, 1 to 3 hours, Prerequisite(s): CS 141; consent of instructor. Individual hardware or software design project to include establishment of objectives and criteria, synthesis, analysis, implementation, testing, and documentation. Course is repeatable to a maximum of 8 units.

ENGR 001M Professional Development and Mentoring (1) Activity, 30 hours per quarter. Prerequisite(s): freshman standing in the Bourns College of Engineering. Provides freshmen

with involvement in professional development activities. Activities to be performed are program-specific, and may include projects, industry overviews and interactions, involvement with professional societies and clubs, team building, career guidance, and coverage of ethics and lifelong learning issues. E. Bioengineering; F. Chemical Engineering; G. Computer Engineering; I. Computer Science; J. Electrical Engineering; K. Environmental Engineering; M. Computer Science with Business Applications.

ENGR 101M Professional Development and Mentoring (1) Activity, 30 hours per quarter. Prerequisite(s): restricted to class level standing of junior; restricted to major(s) Bioengineering, Bioengineering BS + MS, Chemical Engineering, Chemical Engineering BS + MS, Computer Engineering, Computer Science, Computer Science BS + MS, Electrical Engineering, Electrical Engineering BS + MS, Environmental Engineering, Environmental Engr BS + MS, Materials Science and Engineer, Mechanical Engineering, Mechanical Engineering BS + MS. Provides opportunities with involvement in professional development activities. May include projects, industry overviews and interactions, involvement with professional societies and clubs, team building, career guidance, and coverage of ethics and lifelong learning issues. E. Bioengineering; F. Chemical Engineering; G. Computer Engineering; I. Computer Science; J. Electrical Engineering; K. Environmental Engineering; M. Computer Science With Business Applications.

ENGR 180W Technical Communications (4) Lecture, 3 hours; workshop, 3 hours. Prerequisite(s): ENGL 001B with a grade of C or better, ENGL 007, may be taken concurrently; for concurrent enrollment in ENGL 007, review the course titles or topics in the current online Schedule of Classes to find the corresponding ENGL 007 writing workshop; restricted to class level standing of junior, or senior. Develops oral, written, and graphical communication skills. Includes preparing and critiquing reports, proposals, instructions, and business correspondence. Emphasizes professional and ethical responsibilities and the need to stay current on technology and its global impact on economics, society, and the environment. Fulfills the third-quarter writing requirement for students who earn a grade of "C" or better for courses that the Academic Senate designates, and that the student's college permits, as alternatives to English 001C.

MATH 009A First-Year Calculus (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 005A with a grade of C- or better or MATH 006B. Introduction to the differential calculus of functions of one variable. Credit is awarded for one of the following MATH 009A, MATH 005B, MATH 007A, or MATH 09HA.

MATH 009B First-Year Calculus (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 005B with a grade of C- or better or MATH 009A or MATH 09HA. Introduction to the integral calculus of functions of one variable. Credit is awarded for one of the following MATH 009B, MATH 005C, MATH 007B, or MATH 09HB.

MATH 009C First-Year Calculus (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009B with a grade of “C-” or better or MATH 09HB with a grade of “C-” or better. Further topics from integral calculus, improper integrals, infinite series, Taylor’s series, and Taylor’s theorem. Credit is awarded for only one of MATH 009C or MATH 09HC.

MATH 09HA First-Year Honors Calculus (4) Discussion, 1 hour; lecture, 3 hours. Prerequisite(s): admission to University Honors. Honors course corresponding to MATH 009A. Honors course corresponding to MATH 009A for students with strong mathematical backgrounds. Introduces the differential calculus of functions of one variable. Emphasis is on

theory and rigor Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following MATH 09HA, MATH 005B, MATH 007A, or MATH 009A.

MATH 09HB First-Year Honors Calculus (4) Discussion, 1 hour; lecture, 3 hours. Prerequisite(s): MATH 09HA with a grade of B or better; admission to University Honors. Honors course corresponding to MATH 009B. Honors course corresponding to MATH 009B for students with strong mathematical backgrounds. Introduces the integral calculus of functions of one variable. Emphasis is on theory and rigor. Credit is awarded for one of the following MATH 09HB, MATH 005C, MATH 007B, or MATH 009B.

MATH 09HC First-Year Honors Calculus (4) Discussion, 1 hour; lecture, 3 hours. Prerequisite(s): MATH 09HB with a grade of B or better or MATH 009B with a grade of B or better; admission to University Honors. Honors course corresponding to MATH 009C. Further topics from integral calculus, improper integrals, infinite series, Taylor's series, and Taylor's theorem. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following MATH 09HC, MATH 005C, or MATH 009C.

MATH 031 Applied Linear Algebra (5) Lecture, 3 hours; discussion, 2 hours. Prerequisite(s): CS 010A with a grade of C- or better or MATH 005C with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 09HB with a grade of C- or better. A study of matrices and systems of linear equations, determinants, Gaussian elimination, vector spaces, linear independence and linear transformation, orthogonality, eigenvalues, and eigenvectors. Also examines selected topics and applications. Credit is awarded for one of the following MATH 031 or EE 020B.

STAT 155 Probability and Statistics for Science and Engineering (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009C, may be taken concurrently or MATH 09HC, may be taken concurrently. Covers sample spaces and probability; random variables and probability distributions; elements of statistical inference; and testing and estimation. Also addresses selected topics in multivariate distributions and introduces stochastic processes. Credit is not awarded for STAT 155 if it has already been awarded for STAT 156A or STAT 160A.

STAT 156A Mathematical Statistics with Applications for Data Science I (4) -- *new course*-- Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009C or consent of instructor. Introduction to frequentist probability concepts, random variables, and their distributions. Discussion of key theorems and inequalities in probability theory. Introduction to frequentist methods of point and interval estimation.

STAT 160A Elements of Probability and Statistical Theory (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009C, may be taken concurrently or MATH 09HC, may be taken concurrently. Topics include statistical regularity, probability spaces, fundamental theorems in discrete probability, Bayes' theorem, random variables, densities and distribution functions, and continuous distributions. Credit is awarded for one of the following STAT 160A or STAT 156A.

PSYCHOLOGY CONCENTRATION

PSYC 001 Introductory Psychology 4 Lecture, 3 hours; discussion, 1 hour. An introduction to psychology as an experimental science. Emphasizes topics in cognitive (including learning, memory, sensation, perception), comparative, and physiological psychology.

PSYC 002 Introductory Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): none. Emphasizes topics in developmental psychology, tests and
measurements, social psychology, personality,
and abnormal behavior.

PSYC 011 Psychological Methods: Statistical Procedures 5 Lecture, 3 hours; discussion, 2 hours. Prerequisite(s): MATH 004 with a grade of C- or better or MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 09HA with a grade of B or better or MATH 009B with a grade of C- or better or MATH 09HB with a grade of B or better or MATH 009C with a grade of C- or better or MATH 09HC with a grade of B or better or MATH 010A with a grade of C- or better or MATH 010B with a grade of C- or better or MATH 022 with a grade of C- or better; PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; or a score on the Math Advisory Exam sufficient for placement into MATH 022 or higher. Covers descriptive and inferential statistics, measures of central tendency, variability, and correlation. Introduces sampling distributions, statistical inference, and hypothesis testing.

PSYC 012 Psychological Methods: Research Procedures 6 Lecture, 3 hours; laboratory, 3 hours; research, 3 hours; term paper, 1 hour; extra reading, 2 hours. Prerequisite(s): ENGL 001B with a grade of C or better; PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; MATH 004 with a grade of C- or better or MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 09HA with a grade of B or better or MATH 009B with a grade of C- or better or MATH 09HB with a grade of B or better or MATH 009C with a grade of C- or better or MATH 09HC with a grade of B or better or MATH 010A with a grade of C- or better or MATH 010B with a grade of C- or better or MATH 022 with a grade of C- or better; or equivalent; a score on the Math Advisory Exam sufficient for placement into MATH 022 or higher; consent of instructor is required for students repeating the course. A systematic survey of research methodologies in psychology. Laboratory assignments include evaluating and testing psychological theories; assessing methodologies and research designs; designing and implementing research; collecting data and analyzing statistics; writing research reports; and discussing ethical issues in science.

CBNS 106 Introduction to Neuroscience 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A and BIOL 005B with grades of "C-" or better, CHEM 001A, CHEM 001B, CHEM 001C; or consent of instructor. An introduction to cellular, organismal, and behavioral neuroscience for science majors. Topics include structure and functions of the brain, neurons, and synapses; sensory systems and perception; control of movement; neurobiology of hormones and sexual behavior; biorhythms; learning; memory; and psychoses.

PSYC 109 Advanced Research Methods 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012, each with a grade of “B-” or better; or equivalents; or consent of instructor. Advanced theory and practice of planning, conducting, reporting, and evaluating research in the social and behavioral sciences. Students conduct original research that, if desired, can lead to (and become part of) a senior honors thesis or other senior-level research project. Satisfactory (S) or No Credit (NC) grading is not

available.

PSYC 110 The Brain and Behavior 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of “C-” or better, or equivalents, or consent of instructor. Explores the principles of neuroanatomy and neurophysiology and their relationship to brain function. Topics include sensory and perceptual processes, biological aspects of learning and memory, motivation, emotion, language, and abnormal behavior.

PSYC 112 Neural Mechanisms of Animal Behavior 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 with a grade of “C-” or better or PSYC 110 with a grade of “C-” or better or consent of the instructor. Studies how the nervous systems of vertebrates and invertebrates contribute to and control their behavior. Focuses on aspects of sensory physiology with a brief orientation to the structure and function of nervous systems. Emphasizes a top-down approach to neurobiology, with specific behaviors providing guidelines for an examination of neural mechanisms.

PSYC 113 Pandemic Biopsychology: From Virus to Vaccine 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of C- or better, PSYC 002 with a grade of C- or better, PSYC 011 with a grade of C- or better, PSYC 012 with a grade of C- or better; or consent of instructor. Explores pandemics through analyses of historical events, scientific research investigating viruses related to global outbreaks, human immune response to infection, and how different vaccines (adenovirus, mRNA) are created and function in human systems. Also examines how pandemics impact people’s sense of security, mental health, and personal well-being.

PSYC 115 Drugs and Behavior 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 with a grade of “C-” or better or PSYC 110 with a grade of “C-” or better or consent of instructor. Describes both legal and illegal drugs. Analyzes drug-nervous system interactions and how the use of various drugs (particularly drugs of abuse) affects behavior and psychological well-being.

PSYC 117 Cognitive Neuroscience of Memory and Consciousness 4 Seminar, 3 hours; extra reading, 3 hours. Prerequisite(s): CBNS 106 with a grade of “C-” or better or PSYC 110 with a grade of “C-” or better. Surveys the neural basis of mental processes, focusing on memory and consciousness and their behavioral manifestations. Emphasizes current research literature.

PSYC 120 Cellular Neuroscience: Membrane and Synaptic Phenomena 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or consent of instructor. An examination of cellular and molecular mechanisms of nervous system function using concepts drawn from the study of vertebrates and invertebrates with emphasis on mammalian systems. Cross-listed with CBNS 120.

PSYC 121 Developmental Neuroscience 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or consent of instructor. A study of the development of nervous systems. Examines the cellular and molecular mechanisms of neural development and the determinants of cell birth and death, axonal pathfinding, neuronal connections, and

development of neural systems underlying behavior. Cross-listed with CBNS 121.

PSYC 122 Human Neuroimaging 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 110 or CBNS 106 or consent of instructor. PSYC 122 can be taken without PSYC 122L. An introduction to magnetic resonance imaging in psychological research with an emphasis on the merits and limitations of structural and functional neuroimaging in humans.

PSYC 126 Neuroscience of Learning and Memory 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or PSYC 110; or consent of instructor. Covers mechanisms of learning and memory across levels of analysis including genetic, neuronal, systems, and theory. Topics include the multiple memory systems, memory consolidation, working memory, emotional memory, recognition memory, spatial memory, and human amnesia. Cross-listed with CBNS 126.

PSYC 128 Language and the Brain 4 Lecture, 3 hours; research, 2 hours; extra reading, 2 hours. Prerequisite(s): LING 020 or PSYC 110 or PSYC 135 or CBNS 106; or consent of instructor. Interdisciplinary introduction to the study of language and the brain. Includes brain evolution for language, neural bases for language production and language comprehension, aphasiology and language disorders, and additional special topics. Cross-listed with LING 162.

PSYC 129 Human Neuropsychology 4 Lecture, 3 hours; discussion, 1.5 hours. Prerequisite(s): a grade of “C-” or better in one of the following courses or consent of instructor: CBNS 106, PSYC 110, PSYC 132, PSYC 134, PSYC 135. Surveys how high psychological functions (e.g., perception, memory, language) are organized in the human brain. Special emphasis is on behavioral and cognitive impairments due to brain injury and how they may inform our view of normal cognitive functions.

PSYC 130 Fundamentals of Learning and Conditioning 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 with grades of “C-” or better; or equivalents; or consent of instructor. A survey course that includes both historical and current models of human learning, conditioning, and memory. Provides a good foundation for research or future study in learning and memory by covering fundamental theories established by Pavlov and Skinner while incorporating new theories of human behavioral control.580 |

PSYC 131 Computational and Mathematical Models in Cognitive Science 4 Lecture, 3 hours; extra reading, 1.5 hours; written work, 1.5 hours. Prerequisite(s): a grade of “C-” or better in PSYC 001, PSYC 002, PSYC 011, PSYC 012 or consent of instructor. Introduces students to the technical and theoretical issues involved in using models to understand behavior. Involves analysis of model predictions and simulation of behavioral data. Course is repeatable to a maximum of 12 units if taken with different instructors.

PSYC 132 Perception 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 with grades of “C-” or better; or equivalents; or consent of instructor. An analysis of the role played by sensory mechanisms, experiences, expectations, and needs in

recognizing objects in the environment.

PSYC 133 Human Factors 4 Lecture, 3 hours; extra reading, 3 hours; term paper, 1 hour. Prerequisite(s): a grade of “C-” or better in one of the following courses or consent of instructor: PSYC 132 or PSYC 134. Provides an overview of the human capabilities and limitations considered in the design of personmachine systems. Evaluates factors critical to performance in person-machine systems, including attention, decision making, motor performance, and memory.

PSYC 134 Cognitive Processes 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; PSYC 012 with a grade of C- or better; or consent of instructor. Addresses empirical and theoretical research in several subareas within contemporary cognitive psychology. Subareas include attention, mental representation, information organization and retrieval from memory, psycholinguistics, problem solving, decision making, thinking, and artificial intelligence and computer simulation of cognitive processes.

PSYC 135 Psycholinguistics 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): a grade of “C-” or better in the following courses or consent of instructor: PSYC 001, PSYC 002, PSYC 011, PSYC 012. Introduction to psycholinguistics emphasizing the psychological implications of linguistic theory, including the effect of syntactic structure on the comprehension, production, and retention of speech; the course of language acquisition; and models of the adult language user.

PSYC 140 Social Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 with grades of “C-” or better; or equivalents; or consent of instructor. The relationship between the individual and the group, including such topics as conformity and deviance, attraction and prejudice, altruism and aggression, and the social nature of attitudes.

PSYC 142 Industrial/Organizational Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 002. Introduction to the field of industrial/organizational psychology covering fundamental theory and research in personnel and organizations. Topics include employee selection and training, performance appraisal, motivation, organizational dynamics, leadership, and job satisfaction.

PSYC 148 Topics in Social Psychology 4 Lecture, 3 hours; extra reading or term paper, 3 hours. Prerequisite(s): a grade of “C-” or better in the following courses or consent of instructor: PSYC 001, PSYC 002, PSYC 011, PSYC 012, PSYC 140. Intensive study of selected topics in social psychology such as race relations, attitude formation and change, biases of social science researchers, and the application of psychological principles in community organization. Emphasis is on the study of these areas in natural settings. Specific course content varies. Course is repeatable to a maximum of 16 units.

PSYC 149 The Science of Well-Being 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 and PSYC 002. Covers current theory and research in positive psychology and the scientific study of optimal human functioning. Topics include the causes and benefits of happiness; how happiness can be measured and increased; positive emotions; flow; and human strengths and virtues including optimism, love, altruism, forgiveness, and gratitude.

PSYC 153 Introduction to Clinical Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): a grade of "C-" or better in the following courses or consent of instructor: PSYC 001, PSYC 002, PSYC 011, PSYC 012, PSYC 152. Introduction to the field of clinical psychology. Emphasizes the application and evaluation of techniques of individual and group counseling and therapy. Also addresses the application and evaluation of psychological tests in the assessment of psychological problems.

PSYC 155 Personality Assessment 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): a grade of "C-" or better in the following courses or consent of instructor: PSYC 001, PSYC 002, PSYC 011, PSYC 012, PSYC 150. Covers the assessment of personality through self-report tests, projective tests, and systematic observations. Also entails descriptions of the psychometrics of testing as it applies to the problems in studying personality.

PSYC 160 Life Span Development 5 Lecture, 3 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; PSYC 012 with a grade of C- or better. Introduces the biological, social, and cognitive processes that influence development from the prenatal period through late adulthood. Topics include development in physical, motor, perceptual, cognitive, emotional, and social areas. Includes discussion of issues related to intellectual functioning, personality, social roles and relationships, coping and adjustment, and aging.

PSYC 161 Socioemotional and Personality Development 5 Lecture, 3 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; PSYC 012 with a grade of C- or better; or consent of instructor. A study of the development of human personality from birth through late adolescence. Emphasizes the impact of interpersonal relationships on the acquisition of human traits, emotional reactions, and patterns of adjustment.

PSYC 162 Biological Issues in Development 5 Lecture, 3 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, and PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. Examines biological processes that influence behavior and development across the life span. Discusses contemporary theoretical approaches to the study of biological, genetic, and environmental influences on development. Topics include behavioral genetics, developmental neuroscience, and the impact of early environments and stress on adaptation and resilience.

PSYC 163 Cognitive Development 5 Lecture, 3 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, and PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. An analysis of intellectual development from birth

through maturity and into stages of aging. Discusses historical and contemporary theoretical and experimental approaches to studying the mechanisms of intellectual growth and development.

PSYC 164 Emotional and Behavioral Disorders of Childhood 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012, PSYC 152, and PSYC 160 with grades of C- or better; or equivalents; or consent of instructor. Provides an overview of behavioral and emotional disorders affecting children and adolescents within a developmental context. Examines disorders affecting youth in terms of prevalence, developmental course, and theories. Topics include theoretical models of child psychopathology; diagnostic, assessment, and treatment practices; and the descriptive psychopathology of major childhood disorders.

PSYC 165A The Cultural Bases of Human Development 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, and PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. Examines the social, emotional, and intellectual aspects of human development from a cultural perspective. Covers theory, research, and methods of studying the cultural bases of psychological growth. Topics include socialization practices, parenting, social relations, language and cognition, schooling and academic achievement, acculturation, and ethnicity.

PSYC 165B The Development of Immigrant and Ethnic Minority Youth 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012, and PSYC 160 with grades of "C-" or better; or equivalents; or consent of instructor. Covers current theory and research on the development of immigrant and ethnic minority youth in the United States. Focuses on the social, cultural, and psychological processes influencing the biological, cognitive, and social development of youth from immigrant and ethnic minority families.

PSYC 166A Infancy 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 all with grades of "C-" or better; or consent of instructor. Covers current theory and research on development during the period of infancy. Addresses the key biological, cognitive, emotional, and social developments during this period.

PSYC 166B Childhood 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 all with grades of "C-" or better; or consent of instructor. Covers current theory and research on development during the period of childhood. Addresses the key biological, cognitive, emotional, and social developments during this period.

PSYC 166C Adolescence and Emerging Adulthood 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; PSYC 012 with a grade of C- or better. Covers current theory and research on development during the period of adolescence and the transition to adulthood. Addresses the key biological, cognitive, emotional, and social developments during this period.

PSYC 166D Adulthood and Aging 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 all with grades of “C-” or better; or consent of instructor. Covers current theory and research on development during the period of adulthood and the process of aging. Addresses the key biological, cognitive, emotional, and social developments during this period.

PSYC 167 Psychological Development of Black Children 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 002. This course will analyze both the traditional theoretical approaches to the study of Black children and innovative approaches that are currently being developed by Black psychologists. The course will cover topics in the areas of cognitive, social, and personality development. Cross-listed with ETST 167.

PSYC 168 Psychological Aspects of the Black Experience 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 002. This course examines the interdependence between personal characteristics, Afro-American culture, and the social conditions which foster the Black experience. Group membership, life styles, role factors, and situational settings as social norms will be explored in order to understand the uniqueness of the Black experience. Cross-listed with ETST 168.

PSYC 169 Topics in Developmental Psychology 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 001 with a grade C- or better; PSYC 002 with a grade C- or better; PSYC 011 with a grade C- or better; PSYC 012 with a grade C- or better; PSYC 160 with a grade C- or better or PSYC 161 with a grade C- or better or PSYC 162 with a grade C- or better or PSYC 163 with a grade C- or better. Intensive study in developmental psychology. Stresses literature, methodology, and experimental design and analysis. Specific course content varies. Course is repeatable to a maximum of 16 units as topics change.

PSYC 171 Psychology of Gender 4 Seminar, 3 hours; term paper, 3 hours. Prerequisite(s): PSYC 012 with a grade of “C-” or better or consent of instructor. Examines psychological theory and research on gender, including ethnic and cultural variations in male and female experience. Topics include gender roles, gender development, gender differences and stereotypes, biological influences on gender, gender and health, gender and language, gender and achievement, and men and women in the workplace.

PSYC 175 Psychology and Law 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of C- or better, PSYC 002 with a grade of C- or better or LWSO 100 with a grade of C- or better or LWSO 100H with a grade of B or better. A study of psychological theory and empirical research as it relates to the law. Topics include jury decision making, eyewitness memory, child custody, criminal responsibility and intent, competence, rehabilitation and punishment, ethics and legal responsibilities in therapy, and psychological research.

PSYC 178 Health Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 002 or SOC 001 or SOC 001H. An examination of the importance of interpersonal relationships to physical health and effective medical care. Applies social psychological perspectives to such topics as stress-related diseases, placebo effects, doctor-patient interactions, dying, and the

hospital environment.

BUSINESS CONCENTRATION

BUS 010 Introduction to Business 4 Lecture, 3 hours, discussion, 1 hour. Prerequisite(s): none. Provides an overview of the field of business administration. Explores business goals and strategies, functional areas of business and their integration in policy and decision making, social responsibility, computers in business, and business trends and challenges including the international dimension.

BUS 020 Financial Accounting and Reporting 4 Lecture, 3 hours, discussion, 1 hour. Prerequisite(s): none. A study of the concepts and techniques for measurement and communication of financial information. Includes interpretation of financial statements.

BUS 101 Information Technology Management 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 008; BUS 020; ECON 003; STAT 008; or equivalent; or consent of instructor. Topics include computer hardware and software, business data processing, databases, telecommunications, systems analysis and design, cost-benefit analysis, and systems applications in business. Includes database and spreadsheet projects.

BUS 102 – Ethics and Law in Business and Society 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003; STAT 008; or equivalent; or consent of instructor. Analyzes the legal, ethical, political, and social aspects of the business environment. Topics include ethics and social responsibility, government regulation, corporate governance, and global management issues.

BUS 103 Marketing and Distribution Management 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003 or ECON 003H, STAT 008; or consent of instructor. An introduction to the role of marketing in society emphasizing concepts, marketing methods, and institutions.

BUS 104 Decision Analysis and Management Science 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 008; STAT 008 or STAT 010; or equivalents; or consent of instructor. A survey of deterministic and probabilistic models for decision making. Topics include linear programming and extensions, networks, dynamic programming, decision trees, queuing models, and simulation. Explores the application of these models in decision making. Cross-listed with STAT 104.

BUS 105 Production and Operations Management 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): STAT 008 or STAT 010; or equivalent. Addresses the issues of design and control of production systems in manufacturing and service organizations. Covers product and process selection, capacity planning, location and layout design, project and job scheduling, inventory control, material planning, and quality control.

BUS 106 Introduction to Financial Management 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003 or ECON 003H; STAT 008 or ECON 101; or equivalent; or consent of instructor. An introduction to financial management and financial institutions. Includes time value of money, stock and bond valuation, risk and return, portfolio theory, capital budgeting, capital structure, dividend policy, and financial databases. Cross-listed with ECON 134. Credit is awarded for one of the following BUS 106, ECON 134, or BUS 133.

BUS 107 Organizational Behavior 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003; STAT 008; or equivalent; or consent of instructor. Studies organizations from the behavioral science perspective. Topics include motivation, leadership, communication, groups, organization structure and culture, and control in complex organizations.

BUS 108 Financial Evaluation and Managerial Analysis (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003; STAT 008; or equivalents; or consent of instructor. A study of accounting data used for managerial planning and controlling of business operations. Provides an introduction to manufacturing operations and cost accounting systems, cost-volume-profit analysis, relevant costing, standard costing and variance analysis, and budgeting.

BUS 109 Competitive and Strategic Analysis 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 100W; BUS 103; BUS 108; BUS 106 or ECON 134 or BUS 133; restricted to major(s) Business Administration. Provides an understanding of strategic decision- making processes in organizations, the interrelationships among functional areas, and how decision making is affected by internal and external environments.

BUS 110 Introduction to Data Mining and Visual Analytics 2 Lecture, 2 hours; laboratory, 1 hour; extra reading, 2 hours; written work, 3 hours. Prerequisite(s): BUS 101. Covers the processes, methodologies and practices used to transform data into useful information to support business decision-making. Offers an opportunity to gain insights and hands-on-experience with basic functionality of industry standard data mining and visualization software tools such Tableau, JMP and IBM's Watson Analytic.

BUS 115 Marketing Research 4 Lecture, 3 hours; research, 3 hours. Prerequisite(s): BUS 103. Covers types and sources of marketing information, the marketing research process, and techniques of data collection and analysis, including consumer and customer surveys and test marketing. Examines both quantitative and qualitative research with analysis of the values and limitations of data. Emphasis is placed on evaluation and interpretation of results.

BUS 119 Data-driven Marketing 4 Lecture, 3 hours; individual study, 2 hours; extra reading, 1 hour. Prerequisite(s): BUS 103; or consent of instructor. Examines marketing cases and develops data analytical skills for managerial decision making. Utilizes statistical software to manage, display, and analyze marketing information including consumer survey, relationship management, scanner, and socioeconomic data. Topics include attitude measurement, market segmentation and targeting, competition analysis, market performance analysis, and store location choice.

BUS 123 Spreadsheet Modeling for Decision-Making 4 Lecture, 3 hours; written work, 3 hours. Prerequisite(s): BUS 104 or STAT 104. Introduces the fundamental techniques of using data to make informed management decisions in the presence of uncertainty. Utilizes advanced Microsoft Excel functionality.

BUS 124A Business Analytics 4 Lecture, 3 hours; term paper, 1 hour; written work, 2 hours. Prerequisite(s): STAT 008. Provides fundamental concepts and tools needed to understand the emerging role of business analytics in organizations. Applies basic business analytics tools in a spreadsheet environment. Introduces market-leading techniques that help identify and manage key data from business processes. Provides the essential tools required for data mining and business process re-engineering.

BUS 124B Advanced Business Analytics 4 Lecture, 3 hours; written work, 3 hours. Prerequisite(s): BUS 124A with a grade of C- or better; STAT 008 or STAT 010; CS 008. Teaches statistical methods for descriptive, predictive, and prescriptive analysis. Provides opportunities to apply these acquired skills in various business applications in operations, finance, and marketing. Utilizes tools such as R Programming for data analysis and Tableau for data visualization.

BUS 125 Simulation for Business 4 Lecture, 3 hours; extra reading, 1.5 hours; outside projects, 1.5 hours. Prerequisite(s): BUS 104 or STAT 104; or equivalents. Introduces simulation as a tool for analyzing complex systems. Analyzes and discusses the theory and practice of modeling through simulation. Topics include modeling uncertainty and collecting input data, Monte Carlo simulation techniques, model verification and validation, and sensitivity analysis. Examines applications in finance, marketing, operations, and supply chain management.

BUS 128 Project Planning and Control (4) Lecture, 3 hours; assigned problems and field project, 3 hours. Prerequisite(s): BUS 104/STAT 104 or consent of instructor. Covers issues related to planning and control. Explores the differences between projects and production systems; breakdown structures of project organization and work; sequencing and budgeting; resource management; project evaluation and control; and use of current project management software. Includes application of methodology to a real-world project.

BUS 129 Supply Chain Management 4 Lecture, 3 hours; assigned problems, 3 hours. Prerequisite(s): BUS 105. Focuses on management of the distribution of goods and services from plants, ports, and vendors to customers. Key topics include transportation, inventories, warehousing, materials handling, order processing, packaging, pricing, customer service standards, and warehouse and retail location.

BUS 130 Supply Chain Modeling 4 Lecture, 3 hours; homework problems and preparation for presentations, 3 hours. Prerequisite(s): BUS 104/STAT 104 or BUS 105. Covers the modeling and analysis of decision problems in supply chain management. Includes logistics network design, integration of supply chain operations, and supply and sourcing decisions. Utilizes the electronic spreadsheet as the principal device for building models, as well as addresses the concepts of effective spreadsheet design and use.

BUS 171 Systems Analysis and Design 4 Lecture, 3 hours; extra reading, 2 hours; projects, 1 hour. Prerequisite(s): BUS 101 or equivalent. Involves detailed analysis, specification, design, and implementation of computer-based information systems. Includes economic analyses, evaluation of alternatives, analysis or design tools, and systems project management and planning. Case studies are used.

BUS 172 Information Economics 4 Lecture, 3 hours; assigned cases and project, 3 hours. Prerequisite(s): BUS 103; ECON 003 or ECON 003H. Discusses economic concepts and strategies related to the network economy. Topics include economic issues surrounding information goods, competition in electronic business, pricing strategies, and intellectual property protections. Examines business strategies for the information (software) and infrastructure (hardware) elements of electronic business.

BUS 173 Introduction to Databases For Management 4 Lecture, 3 hours; extra reading, 2 hours; projects, 1 hour. Prerequisite(s): BUS 101 or equivalent. Covers physical and conceptual aspects of database management systems, including familiarity with the variety of database systems based on different data models. Examines the role of database systems in management

information systems (MIS) and issues in database design for effective support of MIS. Requires the use of a database package.

BUS 174 Electronic Commerce (4) Lecture, 3 hours; extra reading, 2 hours; project, 1 hour. Prerequisite(s): BUS 101. Reviews the technological evolution of electronic commerce (EC). Investigates how EC can be used to interact with customers, other organizations, and those within the organization. Studies technical innovations, provides a critical evaluation of strategies, and examines current applications and their impact on the business environment.

BUS 175 Business Data Communications (4) Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): BUS 101. Surveys components of telecommunication systems; examines major design and analysis issues in the development and implementation of computer communication systems. Studies both voice and data communication systems including local area networks, wireless systems, satellite systems, and distributed computer and database systems. Emphasizes evaluation of these systems for business purposes.

BUS 179 Business Application of Geographic Information Systems (4) Lecture, 2 hours; laboratory, 1 hour; extra reading, 2 hours; written work, 3 hours. Prerequisite(s): BUS 101. Includes introduction to and use of geographic information system (GIS) for business applications. Provides basic understanding on how location information is used in business processes for decisions. Offers an opportunity to gain hands-on experience with basic functionality of industry standard business mapping software tools including ArcGIS and Business Analyst Online.

ECON 002 Introduction to Macroeconomics (5) Lecture, 3 hours; discussion, 1 hour; written work, 3 hours. Prerequisite(s): none. An introduction to the study of the economic system from a macro, or aggregate, perspective. Includes analysis of business cycles, economic growth, unemployment, inflation, and the impact of government policies on the level of economic activity. Credit is awarded for one of the following ECON 002 or ECON 002H.

ECON 003 Introduction to Microeconomics 5 Lecture, 3 hours; discussion, 1 hour; written work, 3 hours. Prerequisite(s): none. An introduction to the study of the economic system from the micro, or individual decision-maker's, perspective. Includes the study of opportunity cost, markets, consumption, production and competition. Credit is only awarded for one of ECON 003 or ECON 003H.

ECON 002H Honors Introduction to Macroeconomics (5) Lecture, 3 hours; discussion, 1 hour; term paper, 3 to 3.5 hours. Prerequisite(s): admission to University Honors. Honors course corresponding to ECON 002. An introduction to the study of the economic system from a macro, or aggregate, perspective. Includes analysis of business cycles, economic growth, unemployment, inflation, and the impact of government policies on the level of economic activity. Satisfactory (S) or No Credit (NC) grading is not available. Credit is awarded for only one of ECON 002 or ECON 002H.

ECON 003H Honors Introduction to Microeconomics (5) Lecture, 3 hours; discussion, 1 hour; term paper, 3 to 3.5 hours. Prerequisite(s): admission to University Honors or consent of instructor. An introduction to the study of the economic system from a micro, or individual decision-maker's, perspective. Includes the study of opportunity cost, markets, consumption, production and competition. Satisfactory (S) or No Credit (NC) grading is not available. Credit is only awarded for one of ECON 003 or ECON 003H.

ECON 101 Statistics For Economics 5 Lecture, 3 hours; discussion, 1 hour; laboratory, 1 hour;

individual study, 2 hours. Prerequisite(s): MATH 007A or MATH 009A or MATH 09HA or MATH 022; or equivalent. An introduction to the basic statistical methods for economics. Topics include economic data analysis, index numbers, univariate and bivariate probability distributions, correlation and regression, sampling distributions, properties of estimators, and hypothesis testing.

STAT 008 Statistics For Business 5 Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): CS 008 or CS 009A or CS 010A; MATH 004 or MATH 005A or MATH 006B or MATH 007A or MATH 009A or MATH 09HA or MATH 022; or equivalent. An introduction to statistics using business applications. Topics include descriptive statistics; probability; discrete and continuous distributions; Bayes' theorem; random variables; estimation and confidence intervals; hypothesis testing; and simple linear regression. Credit is awarded for one of the following STAT 008 or STAT 010.

STAT 010 Introduction to Statistics 5 Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): MATH 005A or MATH 006B or MATH 007A or MATH 009A or MATH 09HA. A general introduction to descriptive and inferential statistics. Topics include histograms; descriptive statistics; probability; normal and binomial distributions; sampling distributions; hypothesis testing; and confidence intervals. Credit is awarded for one of the following STAT 010 or STAT 008.

SOC 150 The Sociology of Economic Organizations (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): upper-division standing or consent of instructor. Examines how the scope and nature of formal and informal organizations are shaped by sociological processes external to them, such as the influence of governments, institutions, networks, and resources. Illustrates the processes with examples from contemporary United States and from other periods and cultures.

PRE-MEDICINE CONCENTRATION

BIOL 005A Introduction to Cell and Molecular Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 05LA (may be taken concurrently) or BIOL 020 (may be taken concurrently) with grades of "C-" or better; CHEM 001A and CHEM 01LA with grades of "C-" or better or CHEM 01HA and CHEM 1HLA with grades of "C-" or better; consent of instructor is required for students repeating the course. An intensive course designed to prepare for upper-division courses in cell and molecular biology. Covers biochemical, structural, metabolic, and genetic aspects of cells. Required for Biology majors; recommended for science majors desiring an introduction to biology.

PHYS 002A General Physics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in PHYS 02LA; MATH 007A with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 09HA with a grade of C- or better. Covers topics in classical mechanics including Newton's laws of motion in one and two dimensions; gravity; work, energy, and conservation of energy; momentum and collisions; rotational motion; and orbital motion. First part of the course covers the principles of physics underlying the biological and life sciences. Credit is awarded for one of the following PHYS 002A, PHYS 02HA, PHYS 040A, PHYS 040HA, or PHYS 041A.

PHYS 002B General Physics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s):

concurrent enrollment in PHYS 02LB; MATH 007B, may be taken concurrently or MATH 009B, may be taken concurrently or MATH 09HB, may be taken concurrently; PHYS 002A with a grade of C- or better or PHYS 02HA with a grade of C- or better; PHYS 02LA with a grade of C- or better or PHYS 02HLA with a grade of C- or better. Second part of the introductory course that covers the principles of physics underlying the biological and life sciences. Topics include fluids and fluid flow; thermodynamics; mechanical oscillations; sound and light waves; geometrical optics; reflection; refraction; lens; microscopy; interference; and diffraction. Credit is awarded for one of the following PHYS 002B, PHYS 02HB, PHYS 040B, PHYS 040HB, or PHYS 041B.

PHYS 002C General Physics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in PHYS 02LC; PHYS 002B with a grade of C- or better or PHYS 02HB with a grade of C- or better; PHYS 02LB with a grade of C- or better or PHYS 02HLB with a grade of C- or better. Third part of an introductory course covering the principles of physics underlying the biological and life sciences. Topics include electromagnetism, quantum physics, and Coulomb's Law. Covers electric field, electrical potential, resistors, capacitors, simple circuits, magnetic forces and Faraday's Law. Also addresses basic quantum physics of light, atoms, and radioactivity. Credit is awarded for one of the following PHYS 002C, PHYS 02HC, PHYS 040C, PHYS 040HC, or PHYS 041C.

PHYS 02LA General Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 002A; MATH 007A with a grade of C- or better or MATH 009A with a grade of C- or better, MATH 09HA with a grade of C- or better. Illustrates the experimental foundations of physics presented in PHYS 002A. Covers the basic principles of classical mechanics. Credit is awarded for one of the following PHYS 02LA or PHYS 02HLA.

PHYS 02LB General Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 002B; MATH 007B, may be taken concurrently or MATH 009B, may be taken concurrently or MATH 09HB, may be taken concurrently; PHYS 002A with a grade of C- or better or PHYS 02HA with a grade of C- or better; PHYS 02LA with a grade of C- or better or PHYS 02HLA with a grade of C- or better. Illustrates the experimental foundations of physics presented in PHYS 002B. Topics include fluids and fluid flow; thermodynamics; mechanical oscillations; sound and light waves; geometrical optics; reflection; refraction; lens; microscopy; interference; and diffraction. Credit is awarded for one of the following PHYS 02LB or PHYS 02HLB.

PHYS 02LC General Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 002C; PHYS 002B with a grade of C- or better or PHYS 02HB with a grade of C- or better; PHYS 02LB with a grade of C- or better or PHYS 02HLB with a grade of C- or better. Illustrates the experimental foundations of physics presented in PHYS 002C. Topics include electromagnetism, quantum physics, and Coulomb's Law. Covers electric field, electrical potential, resistors, capacitors, simple circuits, magnetic forces, Faraday's Law. Also addresses basic quantum physics of light, atoms, and radioactivity. Credit is awarded for one of the following PHYS 02LC or PHYS 02HLC.

PHYS 02HA Honors General Physics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in PHYS 02HLA; MATH 007A with a grade of B- or better or MATH 009A with a grade of B- or better or MATH 09HA with a grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 002A. A limited enrollment course that covers the principles of physics underlying the biological and life sciences are covered in more depth than in PHYS 002A. Topics in classical mechanics; Newton's laws in one and two dimensions; gravity; work, energy, and conservation of energy; momentum and collisions; and rotational motion. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HA, PHYS 002A, PHYS 040A, PHYS 040HA, or PHYS 041A.

PHYS 02HB Honors General Physics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in PHYS 02HLB; MATH 007B with a grade of B- or better, may be taken concurrently or MATH 009B with a grade of B- or better, may be taken concurrently or MATH 09HB with a grade of B- or better, may be taken concurrently; PHYS 02HA with a grade of B- or better or PHYS 002A with a grade of B- or better; PHYS 02HLA with a grade of B- or better or PHYS 02LA with a grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 002B. Second part of a limited enrollment course in which the principles of physics underlying the biological and life sciences are covered in more depth than in PHYS 002B. Topics include fluids and fluid flow, thermodynamics, mechanical oscillations, sound and light waves, geometrical optics, reflection, refraction, lens, microscopy; interference and diffraction. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HB, PHYS 002B, PHYS 040B, PHYS 040HB, or PHYS 041B.

PHYS 02HC Honors General Physics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in PHYS 02HLC; PHYS 002B with a grade of B- or better or PHYS 02HB with a grade of B- or better; PHYS 02LB with a grade of B- or better or PHYS 02HLB with a grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 002C. A limited enrollment course covering the principles of physics underlying the biological sciences in more depth than PHYS 002B. Covers electromagnetism and quantum physics. Includes Coulomb's Law, electric field, electrical potential, resistors, capacitors, simple circuits, magnetic forces, and Faraday's Law. Also addresses basic quantum physics of light, atoms, and radioactivity. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HC, PHYS 002C, PHYS 040C, PHYS 040HC, or PHYS 041C.

PHYS 02HLA Honors General Physics Laboratory (1) Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 02HA; MATH 007A with a grade of B- or better or MATH 009A with a grade of B- or better or MATH 09HA with a grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 02LA. Illustrates the experimental foundations of physics presented in PHYS 02HA. Covers the basic principles of classical mechanics. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HLA or PHYS 02LA.

PHYS 02HLB Honors General Physics Laboratory (1) Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 02HB; MATH 007B with a grade of B- or better, may be taken concurrently or MATH 009B with a grade of B- or better, may be taken concurrently or MATH

09HB with a grade of B- or better, may be taken concurrently; PHYS 02HA with a grade of B- or better or PHYS 002A with a grade of B- or better; PHYS 02HLA with a grade of B- or better or PHYS 02LA with a grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 02LB. Illustrates the experimental foundations of physics presented in PHYS 02HB. Topics include fluids and fluid flow, thermodynamics, mechanical oscillations, sound and light waves, geometrical optics, reflection, refraction, lens, microscopy, interference, and diffraction. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HLB or PHYS 02LB.

PHYS 02HLC Honors General Physics Laboratory (1) Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 02HC; PHYS 002B with a grade of B- or better or PHYS 02HB with a grade of B- or better; PHYS 02LB with a grade of B- or better or PHYS 02HLB with a grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 02LC. Illustrates the experimental foundations of physics presented in PHYS 02HC. Covers electromagnetism and quantum physics. Includes Coulomb's Law, electric field, electrical potential, resistors, capacitors, simple circuits, magnetic forces, and Faraday's Law. Also addresses basic quantum physics of light, atoms, and radioactivity. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HLC or PHYS 02LC.

CHEM 001A General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LA; MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or CHEM 001W with a grade of S or better or CHEM 001 with a grade of S or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 009C with a grade of C- or better; or a score of 3, 4, or 5 on the College Board Advanced Placement Chemistry Examination or Advanced Placement Calculus Examination or a passing score on the California Chemistry Diagnostic Test or a score on the Mathematics Advisory Exam sufficient for placement in MATH 007A or MATH 009A. An introduction to the basic principles of chemistry. Instructional methods are either in-person lectures or virtual online lectures. Credit is awarded for one of the following CHEM 001A, CHEM 002A, or CHEM 01HA.

CHEM 001B General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LB; CHEM 001A with a grade of C- or better, CHEM 01LA with a grade of C- or better or CHEM 01HA with a grade of C- or better, CHEM 1HLA with a grade of C- or better or CHEM 002A with a grade of C- or better, CHEM 02LA with a grade of C- or better. An introduction to the basic principles of chemistry. Provides lectures either in person or in a virtual online environment, depending on section offerings. Credit is awarded for one of the following CHEM 001B, CHEM 002B, or CHEM 01HB.

CHEM 001C General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LC; CHEM 001B with a grade of C- or better or CHEM 01HB with a grade of C- or better; CHEM 01LB with a grade of C- or better or CHEM 1HLB with a grade of C- or better or CHEM 002B with a grade of C- or better, CHEM 02LB with a grade of C-

or better. An introduction to the basic principles of chemistry. Provides lectures either in person or in a virtual online environment, depending on section offerings. Credit is awarded for one of the following CHEM 001C, CHEM 002C, or CHEM 01HC.

CHEM 01HA Honors General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 1HLA; MATH 007A, may be taken concurrently or MATH 009A, may be taken concurrently or MATH 09HA, may be taken concurrently or MATH 007B or MATH 009B or MATH 09HB; or equivalent or a score of 4 or 5 on the College Board Advance Placement Chemistry Examination; a score of 600 or higher on the Mathematics portion of the SAT Reasoning Test or a score of 25 or higher on the ACT Mathematics Test; high school chemistry; or consent of instructor. Honors course corresponding to CHEM 001A. Covers the principles of chemistry in greater depth than in CHEM 001A. A limited enrollment course. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 01HA, CHEM 001A, or CHEM 002A.

CHEM 01HB Honors General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 1HLB; CHEM 001A with a grade of B or better or CHEM 01HA with a grade of B or better or CHEM 01LA with a grade of B or better or CHEM 1HLA with a grade of B or better or CHEM 002A with a grade of B or better or CHEM 02LA with a grade of B or better; admission to University Honors. Honors course corresponding to CHEM 001B. Covers the principles of chemistry in more depth than in CHEM 001B. A limited enrollment course. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 01HB, CHEM 001B, or CHEM 002B.

CHEM 01HC Honors General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 1HLC; CHEM 001B with a grade of B or better or CHEM 01HB with a grade of B or better or CHEM 002B with a grade of C- or better; CHEM 01LB or CHEM 1HLB or CHEM 02LB; admission to University Honors. Honors course corresponding to CHEM 001C. Covers the principles of chemistry in more depth than in CHEM 001C. A limited enrollment course. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 01HC, CHEM 001C, or CHEM 002C.

CHEM 1HLA Honors General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 01HA; MATH 009A, may be taken concurrently or MATH 009B, may be taken concurrently or MATH 09HA, may be taken concurrently or MATH 007A, may be taken concurrently or MATH 007B, may be taken concurrently or MATH 009C, may be taken concurrently or CHEM 001 or CHEM 001W; admission to University Honors. Honors course corresponding to CHEM 01LA. An introduction to laboratory principles and techniques related to lecture topics in CHEM 01HA. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 1HLA, CHEM 01LA, or CHEM 02LA.

CHEM 1HLB Honors General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 01HB; CHEM 001A with a grade of B or better, CHEM 01LA with a grade of B or better or CHEM 01HA with a grade of B or better, CHEM 1HLA with a grade of B or better or CHEM 002A with a grade of B or better, CHEM 02LA with a grade of B or

better; admission to University Honors. Honors course corresponding to CHEM 01LB. An introduction to laboratory principles and techniques related to lecture topics in CHEM 01HB. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 1HLB, CHEM 01LB, or CHEM 02LB.

CHEM 1HLC Honors General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 01HC; CHEM 001B with a grade of B or better or CHEM 01HB with a grade of B or better or CHEM 002B; CHEM 01LB or CHEM 1HLB or CHEM 02LB; admission to University Honors. Honors course corresponding to CHEM 01LC. An introduction to laboratory principles and techniques related to lecture topics in CHEM 01HC. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 1HLC, CHEM 01LC, or CHEM 02LC.

CHEM 01LA General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001A; MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or CHEM 001W with a grade of S or better or CHEM 001 with a grade of S or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 009C with a grade of C- or better; or a score of 3, 4, or 5 on the College Board Advanced Placement Chemistry Examination or Advanced Placement Calculus Examination or a passing score on the California Chemistry Diagnostic Test or a score on the Mathematics Advisory Exam sufficient for placement in MATH 007A or MATH 009A. An introduction to laboratory principles and techniques related to lecture topics in CHEM 001A. Credit is awarded for one of the following CHEM 01LA, CHEM 02LA, or CHEM 1HLA.| **221**

CHEM 01LB General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001B; CHEM 001A with a grade of C- or better or CHEM 01HA with a grade of C- or better or CHEM 01LA with a grade of C- or better or CHEM 1HLA with a grade of C- or better or CHEM 002A with a grade of C- or better or CHEM 02LA with a grade of C- or better. An introduction to laboratory principles and techniques related to lecture topics in CHEM 001B. Credit is awarded for one of the following CHEM 01LB, CHEM 02LB, or CHEM 1HLB.

CHEM 01LC General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001C; CHEM 001B with a grade of C- or better or CHEM 01HB with a grade of C- or better or CHEM 002B; CHEM 01LB or CHEM 1HLB or CHEM 02LB. An introduction to laboratory principles and techniques related to lecture topics in CHEM 001C. Credit is awarded for one of the following CHEM 01LC, CHEM 02LC, or CHEM 1HLC.

CHEM 008A Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LA; CHEM 001C with a grade of C- or better, CHEM 01LC with a grade of C- or better or CHEM 01HC with a grade of C- or better, CHEM 1HLC with a grade of C- or better or CHEM 002C with a grade of C- or better, CHEM 02LC with a grade of C- or better. Covers modern organic chemistry including hydrocarbon structure and nomenclature, stereochemistry, and reaction mechanisms. Provides lectures either in person or in a virtual online environment,

depending on section offerings. Credit is awarded for one of the following CHEM 008A or CHEM 08HA.

CHEM 008B Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LB; CHEM 008A with a grade of C- or better, CHEM 08LA with a grade of C- or better or CHEM 08HA with a grade of C- or better, CHEM 08HLA with a grade of C- or better. Covers modern organic chemistry including structural determination via spectroscopic analysis, reactivity, reaction mechanisms, and multistep organic synthesis. Credit is awarded for one of the following CHEM 008B or CHEM 08HB.**222** |

CHEM 008C Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LC; CHEM 008B with a grade of C- or better, CHEM 08LB with a grade of C- or better or CHEM 08HB with a grade of C- or better, CHEM 08HLB with a grade of C- or better. Covers modern organic chemistry and chemical biology including reactivity and synthesis. Also includes reaction mechanisms and the chemistry of carbohydrates, lipids, nucleic acids, amino acids, and proteins. Credit is awarded for one of the following CHEM 008C or CHEM 08HC.

CHEM 08HA Honors Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08HLA; CHEM 001C with a grade of B or better, CHEM 01LC with a grade of B or better or CHEM 01HC with a grade of B or better, CHEM 1HLC with a grade of B or better or CHEM 002C with a grade of B or better, CHEM 02LC with a grade of B or better; admission to University Honors; or consent of instructor. Honors course corresponding to CHEM 008A. Covers the principles of organic chemistry in greater depth than in CHEM 008A. Covers modern organic chemistry including hydrocarbon structure and nomenclature, stereochemistry, and reaction mechanisms. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 08HA or CHEM 008A.

CHEM 08HB Honors Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08HLB; CHEM 008A with a grade of B or better, CHEM 08LA with a grade of B or better or CHEM 08HA with a grade of B or better, CHEM 08HLA with a grade of B or better; admission to University Honors; or consent of instructor. Honors course corresponding to CHEM 008B. Honors course that covers the principles of organic chemistry in greater depth than in CHEM 008B. Covers modern organic chemistry including structural determination via spectroscopic analysis, reactivity, reaction mechanisms and multistep organic synthesis. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 08HB or CHEM 008B.

CHEM 08HC Honors Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08HLC; CHEM 008B with a grade of B or better, CHEM 08LB with a grade of B or better or CHEM 08HB with a grade of B or better, CHEM 08HLB with a grade of B or better; or consent of instructor. Honors course corresponding to CHEM 008C. Covers modern organic chemistry and chemical biology including reactivity, synthesis, and reaction mechanisms. Also includes the chemistry of carbohydrates, lipids, nucleic acids, amino acids, and proteins. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 08HC or CHEM 008C.

CHEM 08HLA Honors Organic Chemistry Lab 1 Laboratory, 4 hours. Prerequisite(s): CHEM 001C with a grade of C- or better, CHEM 01LC with a grade of C- or better or CHEM 01HC with a grade of C- or better, CHEM 1HLC with a grade of C- or better or CHEM 002C with a grade of C- or better, CHEM 02LC with a grade of C- or better; admission to University Honors. Honors course corresponding to CHEM 08LA. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 08HLA or CHEM 08LA.

CHEM 08HLB Honors Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): CHEM 008A and CHEM 08LA or CHEM 08HA and CHEM 08HLA with a grade of “B” or better or consent of instructor; concurrent enrollment in CHEM 08HB or a grade of “B” or better in CHEM 08HB. Honors course corresponding to CHEM 08LB in depth. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Satisfactory (S) or No Credit (NC) grading is not available. Credit is awarded for only one of CHEM 08LB or CHEM 08HLB.

CHEM 08HLC Honors Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): CHEM 008B and CHEM 08LB or CHEM 08HB and CHEM 08HLB with a grade of “B” or better or consent of instructor; concurrent enrollment in CHEM 08HC or a grade of “B” or better in CHEM 08HC. Honors course corresponding to CHEM 08LC in depth. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Satisfactory (S) or No Credit (NC) grading is not available. Credit is awarded for only one of CHEM 08LC or CHEM 08HLC.

CHEM 08LA Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): concurrent enrollment in CHEM 008A; CHEM 001C with a grade of C- or better, CHEM 01LC with a grade of C- or better or CHEM 01HC with a grade of C- or better, CHEM 1HLC with a grade of C- or better or CHEM 002C with a grade of C- or better, CHEM 02LC with a grade of C- or better. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Credit is awarded for one of the following CHEM 08LA or CHEM 08HLA.

CHEM 08LB Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): CHEM 008A and CHEM 08LA or CHEM 08HA and CHEM 08HLA with grades of “C-” or better; concurrent enrollment in CHEM 008B or a grade of “C-” or better in CHEM 008B. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Credit is awarded for only one of CHEM 08LB or CHEM 08HLB.

CHEM 08LC Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): CHEM 008B and CHEM 08LB or CHEM 08HB and CHEM 08HLB with grades of “C-” or better; concurrent enrollment in CHEM 008C or a grade of “C-” or better in CHEM 008C. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Credit is awarded for only one of CHEM 08LC or CHEM 08HLC.

BIOL 005B Introduction to Organismal Biology 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A with a grade of C- or better; BIOL 05LA with a grade of C- or better

or BIOL 020 with a grade of C- or better; CHEM 001A, CHEM 01LA or CHEM 01HA, CHEM 1HLA or CHEM 002A, CHEM 02LA; CHEM 001B, may be taken concurrently, CHEM 01LB, may be taken concurrently or CHEM 01HB, may be taken concurrently, CHEM 1HLB, may be taken concurrently or CHEM 002B, may be taken concurrently, CHEM 02LB, may be taken concurrently. An intensive course designed to prepare for upper-division courses in organismal biology. Covers developmental biology, physiology, and regulation at the level of the organism. Required for Biology majors; recommended for science majors desiring an introduction to biology.

BIOL 005C Introductory Evolution and Ecology 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A with a grade of C- or better; BIOL 05LA with a grade of C- or better or BIOL 020 with a grade of C- or better; BIOL 005B with a grade of C- or better; MATH 009A with a grade of C- or better or MATH 09HA with a grade of C- or better or MATH 007A with a grade of C- or better; CHEM 001C, may be taken concurrently, CHEM 01LC, may be taken concurrently or CHEM 01HC, may be taken concurrently, CHEM 1HLC, may be taken concurrently or CHEM 002C, may be taken concurrently, CHEM 02LC, may be taken concurrently. An intensive introduction to the subjects of evolution and ecology. Covers population dynamics, community ecology, population genetics, and evolutionary theory. Recommended for science majors desiring an introduction to biology. Students who take equivalent first-year biology at another institution may enter directly into BIOL 005C without critical handicap.

BIOL 05LA Introduction to Cell and Molecular Biology Laboratory 1 Laboratory, 3 hours. Prerequisite(s): BIOL 005A (may be taken concurrently); consent of instructor is required for students repeating the course. An introduction to laboratory exercises on fundamental principles of and techniques in cell and molecular biology. Illustrates the experimental foundations of the topics covered in BIOL 005A. Credit is awarded for only one of BIOL 020 or BIOL 05LA.

BIOL 102 Introductory Genetics 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 020 or BIOL 05LA, and BIOL 005B with grades of “C-” or better. An introductory course that includes classical Mendelian genetics, linkage and recombination, sex-linked traits, cytogenetics, developmental genetics, and molecular genetics. Also includes some probability theory and statistics.

BIOL 107A Molecular Biology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 008C and CHEM 08LC, or CHEM 08HC and CHEM 8HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BHC 110HA. The study of the structure and function of the genetic material, including DNA structure, DNA replication and recombination, regulation of gene expression, and protein synthesis. Examines both prokaryotic and eukaryotic systems including contemporary recombinant DNA technology and applications of molecular cloning procedures. Credit is not awarded for BIOL 107A if it has already been awarded for BCH 110C.

BIOL 110 Biology of Human Problems 4 Seminar, 4 hours. Prerequisite(s): BIOL 005A, BIOL

005B, BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 008C and CHEM 08LC, or CHEM 08HC and CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA; one course in statistics. Devoted to selected human problems that have a large biological component and relate to medicine, ethics, and human existence. Topics covered vary and include issues of major bioethical importance such as euthanasia, national health care, effects of industrial pollution on individuals and communities, population problems, abortion, and genetic engineering.

BIOL 121 Introductory Microbiology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A; BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 001C or CHEM 01HC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002A, may be taken concurrently or PHYS 02HA, may be taken concurrently; PHYS 02LA, may be taken concurrently or PHYS 02HLA, may be taken concurrently; BCH 100, may be taken concurrently or BCH 110A, may be taken concurrently or BCH 110HA, may be taken concurrently; STAT 010; or consent of instructor. An intensive introduction to the fundamental physiology and molecular biology of bacteria and viruses. Covers bacterial and viral molecular genetics, an introduction to microbial pathogenesis, and applications of microbiology in modern societies. Cross-listed with MCBL 121. Credit is awarded for one of the following MCBL 121, BIOL 121, or MCBL 131.

BIOL 121L Microbiology Laboratory 3 Lecture, 1 hour; laboratory, 6 hours. Prerequisite(s): BIOL 121 with a grade of C- or better or MCBL 121 with a grade of C- or better. Laboratory exercises in diagnostic bacteriology, basic virology, and epidemiology. Includes fundamental quantitative and diagnostic microbiological procedures, basic mechanisms of microbial genetic exchange, and a project examining bacterial epidemiology. Cross-listed with MCBL 121L. Credit is awarded for one of the following MCBL 121L, BIOL 121L, or MCBL 131L.

BIOL 128 Immunology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA. A study of humoral and cellular immunology. Topics include lymphoid systems, cells, antigens, antibodies, antibody formation, cellular immunity, and tumor and transplantation immunology. Discusses in detail diseases and altered immune states associated with each topic. Cross-listed with CBNS 128.

BIOL 161A Functional Anatomy of the Vertebrates 5 Lecture, 3 hours; laboratory, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of C- or better; BIOL 005B with a grade of C- or better; BIOL 005C with a grade of C- or better; CHEM 001C with a grade of C- or better or CHEM 01HC with a grade of C- or better; CHEM 008A with a grade of C- or better or CHEM 08HA with a grade of C- or better, CHEM 08LA with a grade of C- or better or CHEM 08HLA with a grade of C- or better; MATH 007B with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 09HB with a grade of C- or better; PHYS 002A with a grade of C- or better or PHYS 02HA with a grade of C- or better. Functional anatomy of vertebrates including humans. Examines organ systems from developmental and evolutionary perspectives. Topics include phylogeny, the skeleton, and muscles. A combination of BIOL 161A, BIOL 161B, BIOL 171A, BIOL 171B, and BIOL 171L provide a one-year sequence in anatomy and

physiology.

BIOL 161B Functional Anatomy of the Vertebrates 5 Lecture, 3 hours; laboratory, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 161A with a grade of C- or better; CHEM 008B with a grade of C- or better or CHEM 08HB with a grade of C- or better, CHEM 08LB with a grade of C- or better or CHEM 08HLB with a grade of C- or better; PHYS 002B with a grade of C- or better or PHYS 02HB with a grade of C- or better. Functional anatomy of vertebrates including humans. Examines organ systems from developmental and evolutionary perspectives. Topics include nervous system, integument, and circulatory, sensory, respiratory, digestive, and urogenital systems. A combination of BIOL 161A, BIOL 161B, BIOL 171A, BIOL171B, and BIOL 171L provides a one-year sequence in anatomy and physiology.

BIOL 171A Human Anatomy 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 01LC or CHEM 1HLC; CHEM 008B or CHEM 08HB; CHEM 08LB or CHEM 08HLB; MATH 007B or MATH 009B or MATH 09HB; PHYS 002B or PHYS 02HB; PHYS 02LB or PHYS 02HLB. Introduction to the structure of the human body using the an organ-systems approach. Emphasizes an overview of the major elements of human anatomy, a brief introduction to function (i.e., physiology), and the relationships among organs and organ systems. Labs provide hands-on identification of human anatomy.

BIOL 171B Human Physiology 1 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A; BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 01LC or CHEM 01HLC; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002B or PHYS 02HB; PHYS 02LB or PHYS 02HLB; BCH 100 or BCH 110A or BCH 110HA. Provides first-principles analysis of cell, tissue, and organ structure and function. Emphasizes an integrative, problem-solving approach using applications such as disease and exercise. Topics include the musculoskeletal, nervous, endocrine, and reproductive systems.

BCH 100 Introductory Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of C- or better; CHEM 08HB with a grade of C- or better or CHEM 008B with a grade of C- or better; CHEM 08LB with a grade of C- or better or CHEM 08HLB with a grade of C- or better. Introduction to the biochemistry of living organisms based on a study of the structure, function, and metabolism of small molecules and macromolecules of biological significance. Examines selected animals, plants, and microorganisms to develop a general understanding of structure-function relationships, enzyme action, regulation, bioenergetics, and intermediary metabolism. Credit is awarded for one of the following BCH 100 or BCH 100H. Credit is not awarded for BCH 100 if a grade of “C-” or higher has been awarded previously in BCH 110A or BCH 110HA or BCH 110B or BCH 110HB or BCH 110C or BCH 110HC.

BCH 110A General Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of “C-” or better; CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 08HLC with grades of “C-” or better. Considers the structure and function of biological molecules including proteins, carbohydrates, lipids, and nucleic acids. Credit is awarded for only one of BCH 110A or BCH 110HA.

BCH 110B General Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA with a grade of “C-” or better or consent of instructor. Consideration of metabolic pathways including mechanisms and regulation of catabolism, anabolism, and bioenergetics in living organisms. Credit is awarded for only one of BCH 110B or BCH 110HB.

BCH 110C General Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA with a grade of “C-” or better, BIOL 102 or consent of instructor. BCH 110B or BCH 110HB is highly recommended. Considers regulation of gene expression, protein synthesis, chromatin structure, genome replication, recombination, and repair. Examines both prokaryotic and eukaryotic systems, including recombinant DNA technology, protein engineering, and applications to molecular medicine. Credit is not awarded for BCH 110C if it has already been awarded for BCH 110HC or BIOL 107A.

BCH 100H Honors Introductory Biochemistry (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of C- or better; CHEM 008B with a grade of C- or better or CHEM 08HB with a grade of C- or better; CHEM 08LB with a grade of C- or better or CHEM 08HLB with a grade of C- or better; admission to University Honors. Honors course corresponding to BCH 100. Introduction to the biochemistry of living organisms based on a study of the structure, function, and metabolism of small molecules and macromolecules of biological significance. Examines selected animals, plants, and microorganisms to develop a general understanding of structure-function relationships, enzyme action, regulation, bioenergetics, and intermediary metabolism. Credit is awarded for one of the following BCH 100H or BCH 100. Credit is not awarded for BCH 100H if a grade of C- or higher has been awarded previously in BCH 110A or BCH 110HA, BCH 110B or BCH 110HB, or BCH 110C or BCH 110HC.

BCH 110HA Honors General Biochemistry (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of C- or better; CHEM 008C with a grade of C- or better, CHEM 08LC with a grade of C- or better or CHEM 08HC with a grade of C- or better, CHEM 08HLC with a grade of C- or better; admission to University Honors. Honors course corresponding to BCH 110A. Considers the structure and function of biological molecules including proteins, carbohydrates, lipids, and nucleic acids. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following BCH 110HA or BCH 110A.

BCH 110HB Honors General Biochemistry (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A with a grade of C-or better or BCH 110HA with a grade of C- or better; admission to the University Honors Program. Honors course corresponding to BCH 110B. Consideration of metabolic pathways including mechanisms and regulation of catabolism, anabolism, and bioenergetics in living organisms. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following BCH 110HB or BCH 110B.

BCH 110HC Honors General Biochemistry (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA with a grade of “C-” or better. BCH 110B or BCH 110HB is highly recommended. Honors course corresponding to BCH 110C. Considers regulation of gene expression, protein synthesis, chromatin structure, genome replication,

recombination, and repair. Examines both prokaryotic and eukaryotic systems, including recombinant DNA technology, protein engineering, and applications to molecular medicine. Credit is not awarded for BCH 110HC if it has already been awarded for BCH 110C or BIOL 107A.

PBPL 160 Immigrant Health and Wellbeing 4 Lecture, 3 hours; individual study, 2 hours; term paper, 1 hour. Prerequisite(s): restricted to class level standing of junior, or senior. Introduction to community-engaged methods in health disparities research. Examines health disparities and social determinants of health and conducts in-depth examination of community engaged research methods. Provides theoretical principles, methods, and skills needed to plan and implement community-engaged research.

PBPL 162 Health in All Policies 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PBPL 001 with a grade of C- or better or SOC 001 with a grade of C- or better or SOC 001H with a grade of B or better; restricted to class level standing of junior, or senior. Explores social influences on health and the role that public policies play in shaping the social determinants of health. Examines the link between social circumstances (socioeconomics, race, ethnicity, environment) and health outcomes. Identifies connections and considers whether and to what extent public policy mitigates harmful influences or stimulates positive outcomes.

SOC 127 Sociological Determinants of Health 4 Lecture, 3 hours; discussion, 1 hour; extra reading, 5 hours; research, 3 hours. Prerequisite(s): SOC 001 with a grade of C-or better or SOC 001H with a grade of C- or better; or consent of instructor. Introduces the role that social factors play in shaping the occurrence and distribution of disease and death in populations with an emphasis on socioeconomic status, racism, social relationships and social stress. A particular emphasis is placed on sociological origins of health inequalities. Cross-listed with PBPL 127.

SOC 167 Medical Sociology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): restricted to class level standing of junior, or senior; or consent of instructor. Introduces key concepts and theories in medical sociology and their application to a variety of health issues. Exemplar topics include social construction of health and illness, medicalization, stigma and labeling, patient-provider interaction, sociology of medical professionals, social determinants of health, and political economy of health. Cross-listed with PBPL 167.

UC RIVERSIDE
Marlan and Rosemary Bourns College of Engineering

BCOE EXECUTIVE COMMITTEE

February 26, 2025

TO: Ken Barish, Chair
Riverside Division of the Academic Senate

FROM: Victor G. J. Rodgers, Chair
BCOE Executive Committee

RE: Proposed New Program: B.S. in Computer Science Applications

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On February 26, 2025, the BCOE Executive Committee reviewed the Proposed New Undergraduate Academic Program: B.S. in Computer Science Applications (CSA). The committee voted unanimously in favor with a vote of 5 in favor, 0 opposed and 0 abstained.

Bourns College of Engineering
Department of Computer Science & Engineering
900 University Avenue
Riverside, CA 92521

February 25, 2025

To Whom It May Concern,

I enthusiastically support the proposed Computer Science Applications undergraduate major. Current and future students view computers and their constituent technologies as a core parts of society and their lives, intertwined with their other interests. Many students wish to study this intersection. Many employers which to employ students who have a foundational understanding of not only Computer Science but also an application area. Our external advisory board of industry leaders discussed this proposal in June 2024 and enthusiastically supported its curriculum and goals.

This major broadens the existing Computer Science with Business Applications major to invite more undergraduates to explore the combination of Computer Science and other discipline. It will start with concentrations in Business, Psychology, and Health Sciences. We have active and excited partners in each of these areas. We believe it can grow in the future to other areas. This major complements our existing Computer Science and Computer Engineering majors by providing a more applications-oriented, but still technical, study of Computer Science.

The faculty in the Computer Science and Engineering Department (where the program will be housed) voted unanimously (22-0-0) in favor of adding this major. We are committed to providing the necessary courses.

Sincerely,

Christian Shelton
Professor & Department Chair
Computer Science & Engineering

951.827.2554 • cshelton@cs.ucr.edu • www.cs.ucr.edu/~cshelton/

UC RIVERSIDE

Department of Computer Science and Engineering
900 University Avenue
351 Winston Chung Hall
Riverside, CA 92521

DATE: February 7, 2025

TO: Academic Senate
Committee on Educational Policy

FROM: Christian Shelton
Chair, Department of Computer Science

RE: Department approval for new Computer Science Applications major

The Department of Computer Science and Engineering faculty met on Wednesday January 22, 2025 to discuss and vote on this new major proposal. The faculty voted unanimously in favor (22 present, 22 yes) of this new major proposal and to move it forward for approval.

Thank you for your time and consideration.

UC RIVERSIDE
Marlan and Rosemary Bourns
College of Engineering

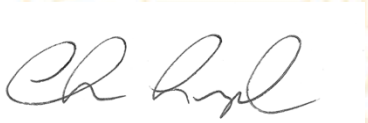
Office of the Dean
900 University Avenue
446 Winston Chung Hall
Riverside, CA 92521

To Whom It May Concern:

I endorse the proposed Computer Science Applications (CSA) undergraduate major. It is well positioned to attract a broad set of students interested in computers and how computational technology is connected to other disciplines. The program creates ties between BCOE and other colleges.

BCOE is committed to supporting this new major by offering the courses, advising, and other resources necessary for its students' success.

Sincerely,



Christopher Lynch
Dean, Bourns College of Engineering
University of California Riverside

TO: Dean Daryle Williams, CHASS

FROM: Tuppett M. Yates, Psychology Department Chair

DATE: February 5, 2025

RE: Support for a Psychology Track within the new Computer Science Applications Major

Dear Dean Williams:

As Chair of the Department of Psychology, I am writing to express our strong support for the proposed undergraduate academic program, the B.S. in Computer Science Applications, to be administered by the Computer Science Department. Our department has voted to unanimously approve the inclusion of Psychology courses to fulfill the Psychology concentration requirements (34 eligible, 29 yes, 0 no, 0 abstain, 5 not available). We believe this major will provide a valuable pedagogical bridge between Computer Science and the Social Sciences.

The Psychology concentration curriculum was carefully designed and approved by faculty in both departments. It offers students a pathway to learn foundational concepts and research methods within psychology, while providing flexibility for students to pursue depth of study in advanced psychological concepts.

Furthermore, the program's emphasis on data analysis training and the flexible senior design project options align with the research interests of many of our faculty who employ sophisticated computational and data science tools in their research programs. Thus, this program will encourage active engagement between undergraduate students and our researchers.

We acknowledge that students in the Computer Science Applications program will increase demand for our already popular Psychology courses, particularly PSYC 11 (Psychological Methods: Statistical Procedures) and PSYC 12 (Psychological Methods: Research Procedures). These are foundational courses within our program with capped enrollment due to their hands-on and intensive nature. Our faculty have agreed to hold seats in these courses for students in the proposed major to accommodate the annual enrollment of up to 30 undergraduate students in this proposed track. Please note that this commitment is contingent upon the ongoing approval of the Committee on Courses to reserve seats in these courses. Each quarter, any unused seats will be released at the same time as the seats for Psychology Majors. Thirty slots are confirmed for the first 5 years with active students in this major after which an assessment will be conducted to see if the number of reserved seats should be increased or decreased.

Looking forward, we are committed to working collaboratively with the Chair of Computer Science and the Dean of the College of Humanities, Arts, and Social Sciences to secure the necessary resources to meet the demands of this proposed major.

Thank you for considering this request.

Tuppett M. Yates, PhD

School of Business
Anderson Hall
900 University Avenue
Riverside, CA 92521

UC RIVERSIDE | School of Business
A. GARY ANDERSON GRADUATE SCHOOL OF MANAGEMENT

VIA EMAIL

February 7, 2025

Dear Colleagues of the Academic Senate,

As Department Chair of the School of Business, I support the proposed new major in Computer Science Applications (CSA) offered by the Department of Computer Science and Engineering of the Marlan and Rosemary Bourns College of Engineering. This new major will be based on the current Computer Science with Business Applications major, the content of which will remain available as a concentration within the new CSA major. This change will continue to make the combination of the computing and business disciplines attractive to a relatively small group of students interested in breadth across both areas.

In addition, I approve the continued inclusion of all BUS courses in the new major, as well as the addition of BUS 10. These courses are offered regularly throughout the academic year. Given the relatively small size of the new major, space in these courses will not be an issue.

Please let me know if you need any additional information.

Sincerely,

Margaret C. Campbell, Chair and Associate Dean

School of Business

Pre-Professional Advising Center
Division of Undergraduate Education

900 University Avenue
Rivera Library B03
Riverside, CA 92521

951.827.6233
hpac@ucr.edu | ppac.ucr.edu

14 February 2025

Re: Letter of Support for Computer Sciences Applications (CSA) Program

Dear Colleagues:

I write this letter of support for the Bachelor of Science in Computer Sciences Application (CSA) Program to be located in the Marlan and Rosemary Bourns College of Engineering at the University of California, Riverside.

The creation of this academic program will allow students who wish to explore a career in computer sciences and health professions to gain the necessary pre-requisite health sciences/life sciences coursework as required by medical schools and other health professions programs such as dentistry, optometry, pharmacy, veterinary medicine and so forth. To date, ~75% of our applicants to health professions programs come from the College of Natural and Agricultural Sciences with viable growth opportunities in all of UCR colleges/schools. For prospective students who are looking to integrate computer sciences and biological sciences and health informatics into clinical practice, this pathway will likely be a popular pathway.

In addition to the health sciences concentration that would provide a direct course flow, students would also have the support of pre-health advisors at the Pre-Professional Advising Center, an advising unit within the Division of Undergraduate Education that provides information, advising, and support for students who aspire to graduate/professional programs in the health professions and law to map out academic and curricular experiences to support a competitive application to medical school or other health professions programs.

Should you have questions regarding this letter of support *or* if I may advocate further on behalf of this new academic program, please don't hesitate to contact me at Charles.Scruggs@ucr.edu or at 951-827-5416.

Sincerely,

Charles P. Scruggs, M.A.
Director, UCR Pre-Professional Advising Center

President, Western Association of Advisors for the Health Professions
Board of Directors, National Association of Advisors for the Health Professions

UC RIVERSIDE | Evolution, Ecology, & Organismal Biology

Joel L. Sachs, PhD Professor & Chair,
Department of Evolution Ecology & Organismal Biology

Professor of Biology & Plant Evolutionary Ecologist
Department of Botany and Plant Science (Cooperating)
Department of Microbiology & Plant Pathology (Cooperating)
Institute of Integrative Genome Biology

University of California
#5406 Boyce Hall
Riverside, CA 92521

Office (951) 827-6357
Fax (951) 827 4286
E-mail: joels@ucr.edu
www.sachslab.com

Dear Neftali,

24, February, 2025

I am writing to express my support for the establishment of a new Computer Science Applications Major (CSA), in particular the CSA major with the concentration in Health Science.

The EEOB faculty discussed the utility of this program and agree with your proposal that this could fulfil a key training need. We agree that the CSA major would be particularly useful for students with career aspirations at the nexus of the computer and health sciences.

We have reviewed the required courses for the CSA major with the concentration in Health Science, including BIOL 005A, BIOL 005LA, BIOL 005B, and BIOL 005C. These courses provide core knowledge in basic biology. Completion of these classes would provide the same training that a typical sophomore would receive after completion of their first year as a Biology major at UCR.

We noted that you also provided for Biology 'technical' electives, including BIOL 102, BIOL 107A, BIOL 110, BIOL 121/L, BIOL 128, BIOL 161 A, BIOL 161B, BIOL 171A, BIOL 171B. We agree that any of these classes would provide important training in addition to the above required courses. In total this could provide preparation for the health sciences in addition to the training in computer sciences.

Joel L. Sachs, Professor & Chair,
Department of Evolution Ecology & Organismal Biology
University of California Riverside

UC RIVERSIDE | College of Humanities, Arts, and Social Sciences

Office of the Dean, 3413 HMNSS Building

MEMORANDUM

To: Christopher Lynch, Dean, Bourns College of Engineering

From: Daryle Williams, Dean, College of Humanities, Arts, and Social Sciences

DocuSigned by: Daryle Williams DF5B1DF553974F3...

Date: February 26, 2025

RE: **Support for the Psychology Concentration in the BS degree program in Computer Science Applications**

As Dean of CHASS, I support the proposed B.S. degree program in Computer Science Applications (CSA) to be administered by the BCOE Computer Science and Engineering Department. This program has three concentrations, two of which are Psychology and Business that rely on the offering of a substantial number of courses offered by the Department of Psychology and a couple courses offered by the Department of Economics. I applaud the initiative of creating interdisciplinary and intercollege majors that will improve the learning experience of our students and respond to a growing demand for professionals with computer science knowledge across many disciplines.

The Psychology department has enthusiastically approved this concentration and I support their endorsement. I concur with their positive assessment on the design of the Psychology concentration curriculum and it is my hope that it will create synergies between undergraduate engineering students and Psychology faculty whose research interests rely on computational and data science tools.

Four courses (PSYC 1, PSYC 2, PSYC 11, and PSYC 12) in the Psychology concentration are considered impacted courses. The proposed CSA major will increase the demand for these courses. CHASS Psychology majors will have priority in enrolling in these courses. The Psychology department is willing to reserve up to 30 seats annually in PSYC 11 and PSYC 12, which have capped enrollments, for the first five years. We should closely monitor enrollments to understand the impact of the new demand and revise the allotment of seats if needed.

I look forward to working with the BCOE Computer Science and Engineering department to assure the success of the proposed major.

Certificate Of Completion

Envelope Id: FDE3259D-50CB-4B1A-B63C-3ADEE6945F24
Status: Completed
Subject: Complete with Docusign: CSAMajor-PSYC-Concentration-2025-02-26.docx
Source Envelope:
Document Pages: 1
Signatures: 1
Certificate Pages: 1
Initials: 0
AutoNav: Enabled
EnvelopeId Stamping: Enabled
Time Zone: (UTC-08:00) Pacific Time (US & Canada)

Envelope Originator:
Summer Espinoza
100 Phoenix Dr.Suite 111
Lansing, MI 48108
summer.espinoza@ucr.edu
IP Address: 138.23.220.221

Record Tracking

Status: Original
2/25/2025 4:51:11 PM
Holder: Summer Espinoza
summer.espinoza@ucr.edu
Location: DocuSign

Signer Events	Signature	Timestamp
Daryle Williams daryle.williams@ucr.edu Dean, CHASS University of California, Riverside Security Level: Email, Account Authentication (None)	DocuSigned by: Daryle Williams DF5B1DF553974F3... Signature Adoption: Pre-selected Style Using IP Address: 169.235.64.141	Sent: 2/25/2025 4:52:17 PM Viewed: 2/25/2025 4:53:18 PM Signed: 2/25/2025 4:53:22 PM

Electronic Record and Signature Disclosure:
Not Offered via Docusign

In Person Signer Events	Signature	Timestamp

Editor Delivery Events	Status	Timestamp

Agent Delivery Events	Status	Timestamp

Intermediary Delivery Events	Status	Timestamp

Certified Delivery Events	Status	Timestamp

Carbon Copy Events	Status	Timestamp

Witness Events	Signature	Timestamp

Notary Events	Signature	Timestamp

Envelope Summary Events	Status	Timestamps
Envelope Sent	Hashed/Encrypted	2/25/2025 4:52:17 PM
Certified Delivered	Security Checked	2/25/2025 4:53:18 PM
Signing Complete	Security Checked	2/25/2025 4:53:22 PM
Completed	Security Checked	2/25/2025 4:53:22 PM

Payment Events	Status	Timestamps

Round 2 Documents

Mathchair <mathchair@ucr.edu> Fri, Feb 14, 2025 at 12:38 PM
To: Neftali Watkinson Medina <neftaliw@ucr.edu>
Cc: Christian Shelton <cshelton@cs.ucr.edu>

Hi Neftali,

After reviewing the proposal, we find nothing to object to. You can say that. But is the Math Department somehow in the chain of approval for the proposal? That would seem to imply something more. I have never been through this kind of thing before.

Regards,
- Jim
[Quoted text hidden]

Neftali Watkinson Medina <neftaliw@ucr.edu> Fri, Feb 14, 2025 at 12:49 PM
To: Mathchair <mathchair@ucr.edu>
Cc: Christian Shelton <cshelton@cs.ucr.edu>

Hi James,

Sorry for not being clear in my prior email. This statement you are providing is enough, it is to satisfy the following requirement by the Committee on Educational Policy:

9. Potential impact of the new program on existing programs. If the proposed program includes required courses from a department other than the administering department, the proposal must include a statement from the department indicating that it has been consulted and that it will provide access to the required courses.

Since your prior email had some suggested changes, I wanted to make sure that you agreed to the fixes I highlighted (primarily removing Math 8). Other than that, your email suffices as the required statement.

Neftali W.
[Quoted text hidden]

Mathchair <mathchair@ucr.edu> Fri, Feb 14, 2025 at 12:55 PM
To: Neftali Watkinson Medina <neftaliw@ucr.edu>
Cc: Christian Shelton <cshelton@cs.ucr.edu>

Hi Neftali,

That is good then. The only other comment I would make is that there is a Math 135C now as well, if you wanted to include it.

Regards,
- Jim
[Quoted text hidden]

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Leonard Mueller
Professor of Chemistry and Chair
Department of Chemistry
University of California, Riverside

(951) 827=3565
leonard.mueller@ucr.edu

20 February 2025

BCOE Executive Committee
UC Riverside

Dear Executive Committee,

As the Chair of the Department of Chemistry, I have reviewed the proposal for an undergraduate major in Computer Science Applications and approve of the addition of the following courses as a requirement for the Health Science concentration:

CHEM 001A and 001LA, CHEM 001B and 1LB, CHEM 001C and 001LC, CHEM 008A and 008LA, CHEM 008B and 8LB, CHEM 008C and 008LC

These courses train students in general and organic chemistry. They serve as the baseline for several programs that require a broad understanding of modern Chemistry. They also serve to satisfy the pre-health requirements for a year of general chemistry with lab, and a year of organic chemistry with lab. It makes sense that a concentration that focuses on Health Science should include these. Both series are taught throughout the year and can accommodate students from the Computer Science applications program.

Sincerely,

Leonard Mueller
Professor of Chemistry and Chair

To: Christian Shelton, Chair and Professor, Computer Science & Engineering Dept.
Neftali D. Watkinson, Assistant Professor of Teaching, Computer Science & Engineering Dept.

From: Shan-Wen Tsai, Chair and Professor, Department of Physics & Astronomy

Date: 02/21/2025

Re: **Letter of Support**

Thank you for sharing with me your proposal for the establishment of a new undergraduate academic program in Computer Science Applications, with Business, Psychology, and Health Science concentrations.

I am happy to provide this letter of support for this new program regarding the inclusion of the following courses in the curriculum: **PHYS 2A and 2LA, PHYS 2B and 2LB, PHYS 2C and 2LC**, to be required for the Health Science concentration as a path towards satisfying the Physics requirement for medical school. The PHYS 2A, B, C and corresponding laboratory portions, PHYS 2LA, B, C are a calculus-based General Physics sequence for Life and Ag Sciences majors, pre-med students, and students who plan to pursue a career in health sciences. The syllabus covers General Physics with life and health sciences applications and integrated labs.

Sincerely,

Shan-wen Tsai

_____

Shan-Wen Tsai, Chair and Professor
Department of Physics and Astronomy

Round 2 Documents

Neftali Watkinson Medina <neftaliw@ucr.edu>

Fwd: Request for letter of support from the Department of Biochemistry

Xuan Liu <xuan@ucr.edu> Fri, Feb 14, 2025 at 10:34 AM
To: Christian Shelton <cshelton@cs.ucr.edu>, Neftali Watkinson Medina <neftaliw@ucr.edu>

Hello.

Sorry for not getting back to you sooner. I was traveling.

We have no issues with non-BCH students taking BCH 100. For BCH 110A, I consulted with our Education Policy Committee as well as BCH 110A instructors. We are all supportive.

Thanks,

Xuan

Xuan Liu
Professor and Chair
Department of Biochemistry
University of California
Riverside, CA 92521
951-827-4350

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COLLEGE OF NATURAL AND AGRICULTURAL SCIENCES
DEPARTMENT OF STATISTICS
900 UNIVERSITY AVENUE
RIVERSIDE, CALIFORNIA 92521

Feb 5, 2025

To: Christian Shelton
Professor and Chair
Computer Science & Engineering Department
Bourns College of Engineering
University of California, Riverside

Dear Prof. Shelton,

I am writing to endorse the proposed new Computer Science Applications (CSA) major, which will replace the existing Computer Science with Business Applications (CSBA) major. The proposed new major includes three distinct concentrations: Business, Psychology, and Health Science. Thus, it offers enhanced flexibility and adaptability for UCR students. The new major will equip students with a strong foundation in computer science principles alongside specialized knowledge in high-demand fields. I understand the proposed new major includes the following statistics courses in the curriculum: STAT 008, STAT010, and STAT 155, and the Department of Statistics pledges to provide seats to these courses for all CSA majors.

Sincerely,

Yehua Li

Yehua Li
Professor & Chair of Statistics,
University of California, Riverside
yehuali@ucr.edu
https://profiles.ucr.edu/app/home/profile/yehuali

Round 2 Documents

R'Mail powered by Google

Neftali Watkinson Medina <neftaliw@ucr.edu>

Request for letter of support from the School of Public Policy

Bruce Babcock <babcockb@ucr.edu> Wed, Feb 5, 2025 at 10:07 AM
To: Neftali Watkinson Medina <neftaliw@ucr.edu>

Neftali:

You requested a letter of support confirming that students in the new major Computer Science Applications will have access to PBPL 160 (Immigrant Health and Well Being) and PBPL 162 (Health in All Policies). SPP does not restrict enrollment in these two courses other than placing an overall cap on class size so students in the major will have the same access as any other students.

Bruce Babcock
Professor and Associate Dean
School of Public Policy
4123 INTS
University of California, Riverside
babcockb@ucr.edu

[Quoted text hidden]

Round 2 Documents

R'Mail powered by Google

Neftali Watkinson Medina <neftaliw@ucr.edu>

Request for letter of support from the Department of Sociology

Robert Clark <roclark@ucr.edu> Tue, Jan 28, 2025 at 6:40 PM
To: Neftali Watkinson Medina <neftaliw@ucr.edu>
Cc: Christian Shelton <cshelton@cs.ucr.edu>

Hi, Neftali.

This all sounds fine to me. I can't promise when (or how frequently) we'll offer SOC 127 or 167, as we are understaffed regarding instructors. And I don't remember seeing SOC 150 being offered since I arrived here a few years ago (nor can I think of any close alternatives). But I have no objections to your including any of these courses in your curriculum. Best of luck to you!

****
Rob Clark
Professor and Acting Chair
Department of Sociology
University of California-Riverside
Riverside, CA 92521
roclark@ucr.edu

[Quoted text hidden]

UNIVERSITY OF CALIFORNIA
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DEPARTMENT OF ECONOMICS

Joseph Cummins
Associate Professor of Economics
3106 Sproul Hall
University of California, Riverside
900 University Avenue
Riverside, CA 92521

Tel: (951) 827-1582
Fax: (951) 827-5685
email: joseph.cummins@ucr.edu

March 17, 20245

To Whom it May Concern,

This letter is intended to communicate the support of the Economics Dept. for the new Computer Science Applications (CSA) major. The major has the support of the Chair and Undergraduate Advisory Committee (UAC) that I Chair. The Economics Dept. believes the new CSA major will be beneficial to the University and potentially synergistic with the Economics Department going forward.

The CSA major will have as pre-requisites a number of foundational Economics courses (2, 3 and 101). Since the CSA major will replace the existing Computer Science with Business Applications major, it is not likely to directly and immediately alter enrollment in the specific core Economics courses listed as pre-requisites in the short term.

However, we also believe that the new arrangement with computer science is likely to increase cross-disciplinary interest in several current and new Economics courses for CS majors. In particular, the Economics Dept. is currently developing several advanced quantitative courses as part of our proposed Quantitative Economics major, and we believe these courses are likely to see increased demand from CS students who have been exposed to Economics via the CSA major. These courses, including at least one newly approved course in Machine Learning for Economics and Business (Econ 111), will require as a pre-requisite Econ 107 (which has Econ 101 as a pre-requisite). The department anticipates long-term increased demand for such applied econometrics courses (107, 111, and other new courses) stemming from a combination of: a) increased interest in advanced quantitative analysis courses from CSA majors in the short-medium term, and b) increased interest in the CSA major (relative to the current major) in the medium-long term.

The Economics Department, as represented by the Chair and the UAC, fully support the creation of the CSA major, and look forward to continuing to train CS majors in core economic and econometrics principles, and in advanced quantitative methods beyond the core major requirements.

Sincerely,

Joseph Cummins
Associate Professor of Economics

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Tony Givargis
Professor and Chair
Department of Computer Science

3201 Donald Bren Hall
Irvine, CA 92697-3435
givargis@uci.edu

February 5, 2025

To Whom It May Concern:

I am writing to express my enthusiastic support for the proposed Bachelor of Science in Computer Science Applications (CSA) at UC Riverside. As Chair of the Computer Science Department at UC Irvine and a UC Riverside alumnus, I believe this program represents a significant advancement in computer science education and complements the existing offerings within the UC system.

The increasing pervasiveness of technology in modern life has fueled an unabated demand for graduates with expertise in computer science, robotics, and software engineering. Simultaneously, we've seen a surge in demand for multidisciplinary computing programs that equip students to apply computational thinking and skills to other fields. At UC Irvine, they've responded to this need by expanding access to computing pathways through programs like the Bioinformatics minor, Health Informatics minor, the BS in Business Information Management, and the BS in Game Design and Interactive Media.

UCR has also demonstrated leadership in accessible computing education, exemplified by the Data Science program and the current Computer Science with Business Applications program. The proposed evolution of the latter into the CSA major is a timely and strategic move. This agile and flexible framework will allow UCR to adapt to industry needs, positioning students for success in the future.

The chosen concentrations within the CSA program are particularly well-suited to current and projected market demands. The incorporation of business courses builds upon a proven model for success, while the Health concentration will train future healthcare professionals to effectively integrate technology into patient care. Furthermore, the Psychology concentration is exceptionally prescient. With the rise of AI and the growing importance of user interface and experience design, professionals who understand the human element within technological frameworks are essential. This concentration addresses a critical need at the intersection of these two disciplines.

I commend UCR for developing a sustainable model for this new program and am excited to witness its growth. I am confident that the CSA program will create valuable opportunities for UCR students.

Sincerely,

Tony Givargis
Professor and Chair
Department of Computer Science

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Victor C. Joe, MD, MBA, FACS
Clinical Professor of Surgery

Department of Surgery
3800 W Chapman Ave
Suite 6200
Orange, CA 92868
Office: 714-456-5890
Facsimile: 714-456-6048

February 18, 2025

Neftali Watkinson Medina, PhD
Assistant Professor of Teaching
Computer Science & Engineering, UC Riverside

Re: Proposal for a major Computer Science Applications

Dear Dr. Watkinson Medina:

I am writing to express my strong support for the proposed Bachelor of Science in Computer Science Applications at UC Riverside, particularly the Health Science concentration. As a surgeon specializing in Trauma, Burns, Critical Care, and Acute Care Surgery, I have seen firsthand the immense potential of advanced computing—particularly artificial intelligence (AI), machine learning, and data science—in transforming healthcare research, improving patient outcomes, and optimizing healthcare delivery.

Healthcare today is increasingly driven by data, yet there remains a significant gap between frontline healthcare providers and the advanced computational tools that can enhance efficiency, precision, and patient-centered care. The integration of computer science principles into health sciences education will prepare future healthcare professionals to bridge this divide, equipping them with the skills necessary to lead innovations in clinical decision support, predictive analytics, workflow optimization, and electronic health record (EHR) enhancements.

A program like the B.S. in Computer Science Applications with a Health Science concentration is not only timely but essential. By providing students with strong foundations in computational methods alongside rigorous health sciences training, UC Riverside will be cultivating the next generation of clinician-scientists, informaticians, and healthcare leaders who can effectively leverage technology to drive meaningful improvements in patient care, provider well-being, and healthcare system performance.

Personally, I have a deep interest in the application of AI and data science in healthcare but often find that I lack the formal training to independently lead such initiatives. I firmly believe that programs like this will empower future healthcare professionals to take on leadership roles in advancing medical research, quality improvement, and healthcare innovation.

I commend UC Riverside for its forward-thinking approach in designing this interdisciplinary major and strongly encourage its approval and implementation. This program aligns with the evolving needs of healthcare and will position UC Riverside as a leader in training professionals at the intersection of medicine and technology.

Thank you for considering this vital initiative. I would be happy to provide any further insights or assistance as needed.

Sincerely,

Victor C. Joe, MD, MBA, FACS
Clinical Professor & Vice Chair for Quality, UC Irvine Department of Surgery
Vice President, UCI Health Medical Staff

February 2, 2025

Dear UCR Curriculum Committee:

I am writing a letter in support of for the new undergraduate major “Computer Science Applications” (CSA), which will be administered by the Department of Computer Science and Engineering (CSE).

Before providing more detail, I will first give you the background with which to interpret this letter. I am currently a professor, and the founding executive director of the Center for Inclusive Computing at Northeastern University. From 2014-2021 I served as the dean of the Khoury College of Computer Sciences at Northeastern University (with over 6500 students Khoury is one of the largest colleges of computing in the country). In my role as dean, I oversaw the addition of 30 new undergraduate interdisciplinary computing majors at Northeastern. I am a fellow of the ACM, AAAI and AAAS.

In this letter I will first discuss the quality of the proposed new major and how it fits in with other majors on campus, and then provide context on the potential graduate school and job outcomes for students who major in CSA.

UCR has a history with CSA degrees having operated the current CS with Business Applications major for many years. The new CSA degree will be inclusive of the CSBA major and is similar in its design. The difference between the within-discipline CS major and the CSA majors are the addition of concentrations in other fields and the removal of some higher-level math and physics courses in addition to the CS Theory courses (which are only needed for students choosing to go on to graduate schools in CS in the area of Theory – indeed most CS departments no longer require these courses even for within-discipline majors).

Administering the CSA within one department/college makes sense as these majors get started. Indeed when Northestern’s CS College (now called Khoury) started interdisciplinary computing degrees in 2001 all degrees were housed in the College. Looking at the CS requirements, UCR follows the typical first courses required for CS majors everywhere (introduction to programming 1, instrucution to programming 2, and data structures. In addition, students are required to take CS 061 (Computer Architecture), CS 100 (Software Engineering), CS 111 (Discrete Structures), CS 105 (Data Analysis), CS 141 (Algorithms), CS 153 (Operating Systems) and to complete a two-semester project. These courses will allow students to learn the core of CS and to pass technical interviews with tech firms. In addition, students must take 20 technical electives. This will allow them to customize what they learn in CS to match the other discipline. This structure is very similar to that used at Northeastern and UIUC (the other university to implement interdisciplinary computing majors at scale – UIUC has 15 such majors as of 2024). I cannot comment on the concentration area requirements as I am not an expert in any of these fields. But the number of units seems very reasonable to allow students to learn enough of the concentration discipline to understand the complexities and breadth of that field.

In terms of fit with other majors. The CSA allows students to take a different view of CS than the within-discipline major and will appeal to students who are interested in how CS can be applied to other fields. It is not in competition with any other majors to the best of my ability to assess this at another university.

In terms of student outcomes in the proposed CSA major, I turn to my experience as dean of Khoury College of Computer Sciences at Northeastern University. Currently more than half of Khoury's 3500 undergraduate students are pursuing combined computing majors—"combined majors" is Northeastern's name for interdisciplinary degrees. Although our degrees differ a bit in structure from the proposed degrees, the purpose and motivation is similar – in 2025 computer science is critically important for most other fields. We have tracked Northeastern's co-op placement for a decade (our students spend one to three six-month periods on internships as part of their undergraduate degree). We have 89% placement for within-discipline CS majors and 90% placement for combined computing majors. In terms of outcomes post graduation, in December of 2021 we tracked all 2021 graduates for Khoury College and found that placement was in the mid-90's and that there was no difference in placement rates between combined and within-discipline majors. There was a difference in where they were working, with both groups working in tech firms, but combined majors sometimes choosing to work at the juncture of the two disciplines (e.g., a Bio-CS major might work at a pharmaceutical firm). We also have tracked placement in graduate school and find that the only difference is that combined majors sometimes choose the other field to do advanced work (e.g., a Business-CS major choosing an MBA).

In conclusion, CSA's are an exciting step forward in a world in which the problems that need solving are increasingly interdisciplinary.

Sincerely,

Professor, Khoury College of Computer Sciences
Dean of Inclusive Computing,
Founding Executive Director, Center for Inclusive Computing,
Northeastern University

UC RIVERSIDE

Academic Senate
Professor Kenneth Barish
Division Chair

May 9, 2025

To: Victor Rodgers, Chair, BCOE Faculty Executive Committee

From: Ken Barish, Chair, Academic Senate

RE: **Proposed Bachelor of Science (B.S.) in Computer Science Applications (CSA)**

Dear Victor,

The proposed Bachelor of Science in Computer Science was reviewed by the Committee on Courses, Committee on Educational Policy, and the Committee on Planning and Budget. The proposal received support but is being returned so that the recommendations and issues highlighted by the Committee on Courses and the Committee on Educational Policy are addressed in a future revised proposal.

As always, the revised degree program proposal is to be submitted to me as Academic Senate Division Chair (barish@ucr.edu) with a courtesy copy to Director Cherysa Cortez (cherysac@ucr.edu).

Best Regards,

Ken Barish, Chair
Academic Senate

Cc: Professor Watkinson
Student Affairs Manager Smith
Senate Analyst Beatty
Senate Director Cortez

Attachment

UC RIVERSIDE Academic Senate

COMMITTEE ON EDUCATIONAL POLICY

April 22, 2025

To: Ken Barish, Chair
Riverside Division

From: Stephen Kane, Vice Chair
Committee on Educational Policy

Re: Proposed B.S. in Computer Science Applications

The Committee on Educational Policy (CEP) reviewed the proposal for a B.S. in Computer Science Applications at their April 4, 2025 meeting. The Committee voted to return the proposal and request that the program revaluate the unit requirement for the for the Health Science concentration as the number of required units is much higher than the other proposed concentrations. Additionally, the Committee recommends that a four-year plan for students to progress through the major be presented. The Committee recommends that consideration be made to include MATH 005B and MATH 005C as alternative to MATH 009A, MATH 009B, and MATH 009C.

UC RIVERSIDE Academic Senate

COMMITTEE ON COURSES

April 29, 2025

To: Ken Barish, Chair
Riverside Division

From: Erin Rankin, Chair
Committee on Courses

Re: Proposed B.S. in Computer Science Applications

The Committee on Courses reviewed the proposal for a B.S. in Computer Science Applications at their April 24, 2025 meeting and were generally supportive of the proposal.

The Committee did review the proposed changes to the curriculum and recommends the following updates be made to the proposed courses:

- Update the curriculum to reflect that ENGL 001A and ENGL 001B have been renumbered to WRIT 010 and WRIT 020;
- Include the Honors courses for the MATH 009A-C series, ECON 002, ECON 003, PHYS 002A-C series, CHEM 001A-C series, CHEM 001LA-C series, CHEM 008A-C series, CHEM 008LA-C series, BCH 100, and BCH 110A-C series;
- Ensure that the full course number is included in the curriculum i.e. PSYC 1 should be listed as PSYC 001;
- Remove PSYC 152, PSYC 179, and PSYC 181 from the curriculum as they were discontinued;
- Include the cross-listed course for SOC 127, which is PBPL 127.

UC RIVERSIDE

Academic Senate

PLANNING AND BUDGET

April 29, 2025

To: Kenneth Barish, Chair
Riverside Division

From: Juliann Allison, Chair
Committee on Planning and Budget

RE: [Campus Review] Proposal: -*Updated- Bachelor of Science (B.S.) in Computer Science Applications (CSA)*

At our meeting on April 29, 2025, the Committee on Planning and Budget (CPB) reviewed the updated proposal for a new Undergraduate Academic Program: Bachelor of Science (B.S.) in Computer Science Applications. CPB found no cause for financial concern and is generally supportive of the proposal.

UC RIVERSIDE
Marlan and Rosemary Bourns College of Engineering

BCOE EXECUTIVE COMMITTEE

February 26, 2025

TO: Ken Barish, Chair
Riverside Division of the Academic Senate

FROM: Victor G. J. Rodgers, Chair
BCOE Executive Committee

RE: Proposed New Program: B.S. in Computer Science Applications

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On February 26, 2025, the BCOE Executive Committee reviewed the Proposed New Undergraduate Academic Program: B.S. in Computer Science Applications (CSA). The committee voted unanimously in favor with a vote of 5 in favor, 0 opposed and 0 abstained.

Proposal for Establishment of a New Undergraduate Academic Program: B.S. in Computer Science Applications

1. Name of the academic program and the department or unit that will administer the program

The **Computer Science Applications (CSA)** Undergraduate Major will be administered by the Department of Computer Science and Engineering (CSE).

2. A thorough justification, including the motivation for the creation of the program in terms of student interest and professional or academic importance.

As technology permeates every aspect of life, the need for professionals who can bridge the gap between computing and other disciplines is skyrocketing. A recent analysis of the labor market shows a growing demand for professionals with experience in using computer science across other disciplines. According to the Occupational Outlook Handbook from the Bureau of Labor Statistics, the expected growth in demand in cross-disciplinary computing is 16% for Special Effect Artists and Animators (requiring training in computing and media), 41% for Information Research Scientists (requiring computing and psychology), and 21% for Bioinformatics (requiring computing and life sciences). Additionally, the medical community has highlighted for decades the need to have coding[1] and AI[2] literacy as part of pre-medical training, but very few computing programs include required courses for pre-medical training as part of their curriculum, programs that effectively blend these requirements are non-existent.

In a recent survey of 1000 high school and community college students from California and from key markets (Washington, Oregon, Arizona, among others), students showed great interest in pursuing interdisciplinary majors in computer science. The top 5 single-discipline programs that students are considering in applying are Business, Social Sciences, Life Sciences, Pre-Medical training, and Education. However, when asked if they would consider a combined degree, 56% said they would be interested (compared to only 14% who said they would pursue a CS-only degree). When offered professions that involve multidisciplinary training; Video Game designer, CGI engineering, Information Research, Biomedical Engineering, Prompt Engineering, Tech Media, and Bioinformatics research were among the top choices (40%). This shows that there is a clear demand for programs that provide the training that students identify as necessary for the professions they want to pursue. The results are also consistent with research that shows that

[1] Yardimci, A. (2009). Soft computing in medicine. Applied soft computing, 9(3), 1029-1043.
[2] Kolachalama, V. B. (2022). Machine learning and pre-medical education. Artificial intelligence in medicine, 129, 102313.

high school students want CS programs that are multidisciplinary. For female applicants, lack of cross-disciplinary options is the number one reason for not pursuing computer science[3].

Several Top-20 institutions in Computer Science (according to csrankings.org) are creating majors that effectively blend Computer Science with other disciplines. The University of Illinois Urbana-Champaign, Northeastern University, and UT Austin are some examples of top institutions that have created interdisciplinary computing programs. At the UC level, UCSD, Berkeley, and UCSC offer one or two computing programs that are interdisciplinary (such as the **Interdisciplinary Computing and the Arts** Major from UCSD). But none have created a program like the one we envision, an umbrella program that enables multiple concentrations in different disciplines with a strong core in Computer Science. The challenge is both programmatic and administrative. Based on our research at the UC-level, ours could become a model for other UCs to emulate.

The **Computer Science with Business Applications (CSBA)** major at UCR exemplifies this potential structure and would become a sort of template for new ones. The CSBA major is accredited as a CS program, continues to grow along with the traditional CS program, and serves a more diverse student body (40% women). The program requires at least 71 units in Computer Science courses, and 50 units in Business. It is designed to provide depth in both fields while emphasizing the use of computing in business solutions.

This new major will be called the **Computer Science Applications** major, and would include CSBA as a concentration. We will add two additional concentrations to start: Psychology, and Health Science. These were chosen due to high demand for professionals in these areas, synergy among our faculty, and the potential to attract a gender-balanced student population.

3. Relationship of the new program to existing programs

The design of the major is strongly influenced by the current Computer Science with Business Applications Major (CSBA). We will be folding the CSBA major into this new program as a concentration in Business. By this restructuring, we may add additional programmatic pathways that lead to degrees in computing applied towards other disciplines, i.e., Computer Science Applications with a concentration in [X], where X would include Business, Psychology, and Health Science. The computing community refers to such programs as CS+X[4]. Additionally, the list of courses required for the Business concentration will be refreshed to streamline the student experience and include new courses from Business that are currently not considered in the CSBA program.

While being a computing program, CSA is distinct from the Computer Science undergraduate degree. Certain core requirements endemic to Computer Science are not necessary for CSA

[3] Carter, L. (2006). Why students with an apparent aptitude for computer science don't choose to major in computer science. ACM SIGCSE Bulletin, 38(1), 27-31.

[4] Carla E. Brodley, Benjamin J. Hescott, Jessica Biron, Ali Ressing, Melissa Peiken, Sarah Maravetz, and Alan Mislove. 2022. Broadening Participation in Computing via Ubiquitous Combined Majors (CS+X). In Proceedings of the 53rd ACM Technical Symposium on Computer Science Education - Volume 1 (SIGCSE 2022), Vol. 1. Association for Computing Machinery, New York, NY, USA, 544–550. https://doi.org/10.1145/3478431.3499352

majors. For example, extended series of Math and Physics, up to Math 10A, or specific theory or depth courses for advanced work in CS like CS150, CS152, CS120A. These would not be required for the CSA major. Likewise, CS105: Data Analysis Methods, will be required as it is a key course for engaging with other disciplines and gives students exposure to data analysis tools. The most prominent difference is that at least 50 units of the required courses are from courses offered from a different discipline.

The Data Science program is an interdisciplinary program that is administered by the Computer Science and Statistics departments. Courses are taught by faculty from both departments. While similar in nature to CSA (combining Computer Science with a different discipline), the Data Science program has a heavier emphasis on statistical methods. The courses required for both the computing core and for the concentrations within CSA are different from those required by the Data Science program.

4. The proposed curriculum. Great care should be given in this area, correct rubrics should be listed for courses, all cross listings should be listed, unit total considerations should be taken into account and totals should be verified by program staff, faculty, and appropriate Executive Committee personnel. A copy of the proposed program change should be provided for inclusion in the Catalog.

See “Appendix A: Program Description”

5. A list of faculty who will be involved in the program, including those teaching, advising, and administering.

All Senate faculty members of the CSE department (Assistant, Associate, and Full Professors) will be involved in administering the program. A Faculty Advisor for the program will be appointed and will interface with BCOE staff advisors. All faculty members in CSE, including instructors, will be teaching Computer Science courses in the program. Faculty involved in teaching the courses from other departments will only be involved in teaching those courses. Below is the current list of faculty members of the Computer Science and Engineering department:

Distinguished Professor
Rajiv Gupta, Ph.D.
Tao Jiang, Ph.D.
Eamonn Keogh, Ph.D.
Kadangode K. Ramakrishnan, Ph.D.

Professors
Nael Abu-Ghazaleh, Ph.D.
Philip Brisk, Ph.D.
Zizhong Chen, Ph.D.
Evangelos Christidis, Ph.D.
Marek Chrobak, Ph.D.
Emiliano De Cristofaro, Ph.D.
Michalis Faloutsos, Ph.D.
Trent Jaeger, Ph.D.

Srikanth Krishnamurthy, Ph.D.
Stefano Lonardi, Ph.D.
Walid Najjar, Ph.D.
Chinya Ravishankar, Ph.D.
Christian Shelton, Ph.D.
Manu Sridharan, Ph.D.
Vassilis Tsotras, Ph.D.
Frank N. Vahid, Ph.D.
Heng Yin, Ph.D.

Professors Emeriti

Laxmi N. Bhuyan, Ph.D.
Mart L. Molle, Ph.D.
Thomas H. Payne, Ph.D.
Michael Pazzani, Ph.D.
Teodor C. Przymusinski, Ph.D.
Neal Young, Ph.D.

Associate Professors

Ahmed Eldawy, Ph.D.
Ioannis Karamouzas, Ph.D.
Paea LePendu, Ph.D.
Mohsen Lesani, Ph.D.
Evangelos Papalexakis, Ph.D.
Zhiyun Qian, Ph.D.
Mariam Salloum, Ph.D.
Tamar Shinar, Ph.D.
Chengyu Song, Ph.D.
Greg Ver Steeg, Ph.D.
Zhijia Zhao, Ph.D.

Assistant Professors

Amey Bhangale, Ph.D.
Yue Dong, Ph.D.
Yan Gu, Ph.D.
Allan Knight, Ph.D.
Amr Magdy, Ph.D.
Neftali W. Medina, Ph.D.
Silas Richelson, Ph.D.
Elaheh Sadredini, Ph.D.
Craig Schroeder, Ph.D.
Yihan Sun, Ph.D.
Zhaowei Tan, Ph.D.
Mingxun Wang, Ph.D.
Qian Zhang, Ph.D.

6. For interdisciplinary programs, the degree of participation and the role of each department must be explicitly described. The chairs of all participating departments must provide written approval for the creation of the program and indicate their commitment to provide necessary resources including faculty release.

This is not an interdepartmental program in the sense that it does not span, administratively, more than one department. The program will be administered by the CSE department, which teaches the majority of the courses, and admission will be through the College of Engineering. Faculty from other departments are not part of this program's administration.

Letters from all relevant departments (Psychology, Business, Biology, Mathematics, Chemistry, Physics, Biochemistry, Statistics, Public Policy, and Sociology) stating that they agree for our students to take their courses are included.

7. Projected enrollment in the program.

The projected enrollment at the start of the program is 50 students; we expect a class of 80-100 students at steady state. This will include students across all concentrations. Currently CSBA, one of the concentrations, has graduated on average 48 students annually over the last five years.

8. Name of degree, if applicable, and the anticipated number of degrees to be granted when the program reaches steady state

B.S. In Computer Science Applications with Concentration in [X], 80-100 degrees awarded per year.

9. Potential impact of the new program on existing programs. If the proposed program includes required courses from a department other than the administering department, the proposal must include a statement from the department indicating that it has been consulted and that it will provide access to the required courses.

The new major uses five existing lower division courses offered by the Department of Mathematics (namely: MATH 009A, MATH 009B, MATH 009C, MATH 011/CS 011, MATH 031). All these courses are currently being used by CSBA, CSE, and Statistics for satisfying college/major requirements in the BS degrees offered currently by the CSE and Statistics departments. Given that these courses are also being used by many other departments to satisfy college requirements, we do not expect a major impact in their offerings by the new program.

All other lower and upper division courses required for the new major are currently being taught by the Psychology and Business departments.The Health Science concentration lists courses that are offered by various departments and are part of the list of pre required courses for Health Professions. Chairs of the involved departments have been consulted and have agreed to provide access to the required course sequences (please see included letters from relevant departments).

10. A full listing of resources required for start-up and for operations. In cases where no additional resources will be needed, this must be explicitly stated. This listing may include: personnel (faculty FTE or temporary positions, Teaching Assistants or Readers, administrative staff, technical support); support services including computer facilities and library resources; space requirements. A plan indicating how the resources will be obtained would also be helpful to the committee in reviewing the proposal. A letter of support from the College Dean and/or Executive Vice Chancellor-Provost indicating endorsement as well as a promise of support for the proposal also would be extremely helpful.

- Faculty FTE: the program will use existing faculty from the CSE department.
- Teaching assistants: We estimate that, at full capacity, the new program will need 2-3 TA positions per quarter (this is considering a full capacity of 80 students which translates to 30 students above what CSBA currently has). Such cost, however, will be easily covered by the tuition fees of the new students.
- Administrative Staff: the program will be administered by existing staff and faculty in the CSE Department and will be advised by BCOE's Office of Undergraduate Student Academic Affairs (OSAA). OSAA currently has ten full time advisors that will initially accommodate the CSA students. We don't foresee any need for additional advisors.
- Computer facilities and library resources: no new facilities required
- Space requirements: no new space requirements, growth will be part of the existing CSE department expansion plans

Please see the included letter from BCOE's Dean, Christopher S. Lynch.

11. Both internal and external letters of support should be provided with the proposal. Internal letters of support are often from UCR department chairs and faculty of related programs. The external letters should be from other UC campuses or other peer institutions. Letters from off-campus help to establish the quality of the program and its fit within the context of related programs at other universities. Upon consultation with the CEP the demand for external letters may be waived.

We have included the following letters of support:

- A letter from Christian Shelton (Chair of UCR's Department of Computer Science and Engineering), alongside the record of our department's vote, and the official feedback from our Advisory Board denoting strong support for the program.
- Tuppett M Yates (Department of Psychology's Chair), where she expresses both consent and support for the Psychology concentration.
- Margaret C. Campbell (Chair and Associate Dean of the School of Business) to show continuing support of the Business concentration.

- Charles P Scruggs (Director of the UCR Pre-Professional Advising Center) denoting strong support for the Health Science concentration
- Daryle Williams (Dean of the College of Humanities, Arts, and Social Sciences) supporting the Psychology concentration
- Tony Givargis (Chair of the Department of Computer Science at UC Irvine) as external letter of support for the whole program.
- Dr. Victor Joe (Vice President of UCI Health Medical Staff and Clinical Professor of Surgery at UC Irvine), as external letter of support for the Health Science concentration
- Carla Brodley (Professor, Khoury College of Computer Sciences andDean of Inclusive Computing at Northeastern University) as external letter of support for the whole program.

12. Approvals from program faculty, College faculty (if the new proposal affects a college regulation), and the appropriate Executive Committee should be obtained before forwarding the new program to the attention of the Senate Analyst for CEP.

- The Computer Science and Engineering Department voted in favor of the proposal on January 22nd, 2025 (see included record of this vote).
- The program doesn't affect a college regulation
- The BCOE Executive Committee discussed and voted in favor of the proposal on February 26th, 2025

13. All proposals for new programs should be submitted to the Senate Chair no later than March 1 of the academic year prior to the fall quarter in which the proposed program is anticipated to go into effect. This schedule should provide sufficient time for Senate review of the proposal to meet the deadline for final consideration of approval at the May Division Meeting.

Appendix A: Program Description

The **Computer Science Applications program** covers the core of computer science and integrates a second discipline as a concentration area. It prepares students for careers that demand multidisciplinary backgrounds with an emphasis on computational methods, or for graduate studies in either discipline.

The objective of the B.S. degree program in **Computer Science Applications** is to prepare graduates for professional practice in both the private and public sectors and for lifelong learning, including the option to pursue graduate degrees, by providing them with:

- Background: The necessary technical competencies, including knowledge of scientific principles and skill at rigorous analysis and creative design.
- Breadth: A broad education that includes knowledge of current issues and trends in society and technology.
- Professionalism: Professional attitudes and ethics, as well as skills for clear communication and responsible teamwork.
- Learning environment: A learning environment that is rigorous, challenging, open, and supportive.

Change of Major Criteria

All students who request a change of major to Computer Science Applications must meet the following requirements:

- Be in good academic standing.
- Have no less than a C- in any Math, Science, or Engineering coursework.
- Be able to complete the major within maximum allowable units.
- Complete all the courses listed below, based on the total number of units earned, prior to submitting the major change request.
- UCR transfer students interested in changing to a BCOE major must have been admissible to the major at the point of entry or must satisfy transfer admission and change of major requirements before earning 120 units.
- If changing in the 90-119 units category, students must have the ability to complete the major within 5 years of entry as a freshmen or 3 years after entry as a transfer student.
- Students who have earned 120 or more units are not eligible for a change of major in BCOE. NOTE: AP/IB units are excluded from the maximum unit calculation.

Completed 0 to less than 45 units

Completion of ENGL 001A with a grade of C or better, a grade of C or better in CS 009A, and completion of the following with at least a 2.700 GPA:

- CS 009A
- CS 009B
- MATH 009A or MATH 09HA
- Any additional Math/Science/Engineering/CS courses (if taken)

Completed 45 to less than 90 units

Completion of ENGL 001A with a grade of C or better, a grade of C or better in both CS 009A and CS 009B, and completion of the following with at least a 2.700 GPA:

- CS 009A
- CS 009B
- MATH 011/CS 011
- MATH 009A or MATH 09HA
- MATH 009B or MATH 09HB
- MATH 009C or MATH 09HC
- And any additional Math/Science/Engineering/CS courses (if taken)

Completed 90 to less than 120 units

Completion of ENGL 001A and ENGL 001B with a grade of C or better, a grade of C or better in both CS 009A and CS 009B, and completion of the following with at least a 2.700 GPA:

- CS 009A
- CS 009B
- MATH 011/CS 011
- CS 061
- MATH 009A or MATH 09HA
- MATH 009B or MATH 09HB
- MATH 009C or MATH 09HC
- And any additional Math/Science/Engineering/CS courses (if taken)

University Requirements

See the Undergraduate Studies section.

College Requirements

See the Marlan and Rosemary Bourns College of Engineering, Colleges and Programs section.

The Computer Science Applications major uses the following major requirements to satisfy some of the college's Natural Sciences and Mathematics breadth requirements and one of the college's English Composition breadth requirements:

1. MATH 007A or MATH 009A
2. ENGR 180W

Major Requirements

The **Computer Science Applications** major has two sets of requirements: a core set and a concentration set. Courses required by a concentration may also be used to satisfy breadth requirements.

Core requirements

1. Lower-division requirements (38 units)
    a. ENGR 001M
    b. CS 009A and CS 009B and CS 009C

c. CS 010C, CS 061
d. CS 011/MATH 011
e. MATH 009A, MATH 009B, MATH 009C, and either MATH 031 or EE 020B

2. Upper-division requirements (58 units)
   a. ENGR 101M
   b. CS100, CS 111, CS141, CS153
   c. ENGR 180W
   d. STAT 155 or STAT 156A or STAT 160
   e. CS 105
   f. CS 178A, CS 178B
   g. At least twenty (20) units of Computer Science technical electives to be chosen from an approved list of courses which currently includes CS 108, CS110, CS 120A, CS 120B, CS 122A, CS 122B, CS 130, CS131, CS 133, CS 135, CS 142, CS 144, CS 145, CS/EE 147, CS 150, CS 152, CS 160, CS 161, CS 162, CS 164, CS 165, CS 166, CS 167, CS/EE 168, CS 169, CS 170, CS 171, EE 142, CS 172, CS 173, CS 175, CS 177, CS 179 (E-Z) (4 units maximum), CS 180, CS 181, CS 182, CS 183, CS 193 (4 units maximum), MATH 120, MATH 126, MATH 135A, MATH 135B, PHIL 124.

      The technical electives selected for 2.g) must be distinct from those used to satisfy the requirements specified in 2.a)–f) above with at least 16 units selected from Computer Science courses.

Concentration (at least 50 units)
Students in the **Computer Science Applications (CSA)** must declare a concentration upon admission to the program. A change in concentration, if justified, should be made at least three quarters prior to graduation.

3.1. Psychology (51 units)
   h. PSYC 1, PSYC 2
   i. PSYC 11, PSYC 12
   j. At least two courses from CBNS 106 or PSYC 110, PSYC 132 or 134, PSYC 140, PSYC 150, PSYC 160 or PSYC 161 or PSYC 162 or PSYC 163
   k. At least twenty four (24) units of Psychology technical electives to be chosen from an approved list of courses which currently includes PSYC 109, PSYC 112, PSYC 113, PSYC 115, PSYC 117, PSYC 120, PSYC 121, PSYC 122, PSYC 126, PSYC 128, PSYC 129, PSYC 130, PSYC131, PSYC 132, PSYC 133, PSYC 134, PSYC 135, PSYC 140, PSYC 142, PSYC 148,, PSYC 149, PSYC 152, PSYC 153, PSYC 155, PSYC 160, PSYC 161, PSYC 162, PSYC 163, PSYC 164, PSYC 165A, PSYC 165B, PSYC 166A, PSYC 166B, PSYC 166C, PSYC 166D, PSYC 167, PSYC 168, PSYC 169, PSYC 171, PSYC 175, PSYC 178, PSYC 179, PSYC 181

      The technical electives selected for 3.1.d) must be distinct from those used to

satisfy the requirements specified in 3.a)–c) above.

3.2. Business (50 units)

l. BUS 010, BUS 020
m. ECON 002, ECON 003
n. One course of 4 or more units from STAT 008, STAT 010, ECON 101
o. At least two courses from BUS 102, BUS 103, BUS 104, BUS 105, BUS 106, BUS 107, BUS 109
p. At least twenty (20) units of Business technical electives to be chosen from an approved list of courses which currently includes BUS 102, BUS 103, BUS 104, BUS 105, BUS 106, BUS 107, BUS 108, BUS 109, BUS 110, BUS 115, BUS 119, BUS 123, BUS 124A, BUS 124B, BUS 125, BUS 128, BUS 129, BUS 130, BUS 163, BUS 166, BUS 171, BUS 172, BUS 173, BUS 174, BUS175, BUS 179, SOC 150. Additionally, no credit will be given for BUS 101; and the following pairs of courses cannot both be taken for credit: BUS 125 and CS 177, BUS 163 and CS 175, BUS 171 and CS 180, BUS 173 and CS 166, BUS 175 and CS 164.

   The technical electives selected for 3.2.e) must be distinct from those used to satisfy the requirements specified in 3.2.a)–d) above.

3.3 Health Science (71 units)

q. PHYS 2A and 2LA, PHYS 2B and 2LB, PHYS 2C and 2LC
r. CHEM 001A and 001LA, CHEM 001B and 1LB, CHEM 001C and 001LC
s. CHEM 008A and 008LA, CHEM 008B and 8LB, CHEM 008C and 008LC
t. BIOL 005A and BIOL 005LA, BIOL 005B, BIOL 005C
u. BCH 100 or BCH 110 A
v. At least three courses from BIOL 102, BIOL 107A, BIOL 110, BIOL 121/L, BIOL 128, BIOL 161 A, BIOL 161B, BIOL 171A, BIOL 171B, SOC 127, SOC 167, PSYC 160, PSYC 178, BCH 110B, BCH 110C, PBPL 160, PBPL 162.

Course Descriptions:

CS 009A Data Oriented Introduction to Computing I (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): MATH 004, may be taken concurrently or MATH 005A, may be taken concurrently or MATH 006A, may be taken concurrently or MATH 006B, may be taken concurrently or MATH 007A, may be taken concurrently or MATH 009A, may be taken concurrently or MATH 09HA, may be taken concurrently. Covers computational thinking, problem-solving, and data analysis using the Python language through application-based data manipulation tasks from science, engineering, business, and the humanities. Includes variables, expressions, branches, loops, functions, parameters, lists, strings, file I/O, and exception handling. Also covers software design, testing, and debugging. Credit is awarded for one of the following CS 009A or CS 010A.

CS 009B Data Oriented Introduction to Computing II (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 009A; or equivalent. Covers advanced programming concepts and algorithms through application-based data manipulation tasks from science, engineering, business, and the humanities. Emphasizes good programming principles in the design and development of substantial programs using the Python language. Topics include abstract data types, objects and classes, recursion, and basic software engineering principles. Credit is awarded for one of the following CS 009B or CS 010B.

CS 009C C++ For Programmers (2) Lecture, 1 hour; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 009B, may be taken concurrently; MATH 006B, may be taken concurrently or MATH 007A, may be taken concurrently or MATH 005A, may be taken concurrently or MATH 004, may be taken concurrently or MATH 009A, may be taken concurrently or MATH 09HA, may be taken concurrently. Introduces the constructs provided in the C++ programming language for procedural and object-oriented programming. For those with prior programming experience.

CS 010A Introduction to Computer Science For Science, Mathematics, and Engineering I (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): MATH 004, may be taken concurrently or MATH 005A, may be taken concurrently or MATH 006A, may be taken concurrently or MATH 006B, may be taken concurrently or MATH 007A, may be taken concurrently or MATH 009A, may be taken concurrently or MATH 09HA. Covers problem solving through structured programming of algorithms on computers using the C++ object-oriented language. Includes variables, expressions, input/output (I/O), branches, loops, functions, parameters, arrays, strings, file I/O, and classes. Also covers software design, testing, and debugging. Credit is awarded for one of the following CS 010A or CS 009A. Credit is not awarded for CS 005 or CS 008 if it has already been awarded for CS 010A.

CS 010B Introduction to Computer Science For Science, Mathematics, and Engineering II (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 010A with a grade of C- or better; familiarity with C or C++ language. Covers structured and object-oriented programming in C++. Emphasizes good programming principles and development of substantial programs. Topics include recursion, pointers, linked lists, abstract data types, and libraries. Also covers software engineering principles. Credit is awarded for one of the following CS 010B or CS 009B.

CS 010C Introduction to Data Structures and Algorithms (4) Lecture, 3 hours; laboratory, 3

hours. Prerequisite(s): CS 010B with a grade of C- or better or CS 009C with a grade of C- or better; proficiency in C++. Topics include basic data structures such as arrays, lists, stacks, and queues. Covers dictionaries (including binary search trees and hashing) and priority queues (heaps). Offers an introductory analysis of algorithms, sorting algorithms, and object-oriented programming including abstract data types, inheritance, and polymorphism. Explores solving complex problems through structured software development.

MATH/CS 011 Introduction to Discrete Structures (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010A or MATH 005C or MATH 007B or MATH 009B or MATH 09HB. Introduction to basic concepts of discrete mathematics emphasizing applications to computer science. Topics include propositional and predicate calculi, elementary set theory, functions, relations, proof techniques, elements of number theory, enumeration, and discrete probability. Cross-listed with CS 011. Cross-listed with CS 011.

CS 061 Machine Organization and Assembly Language Programming (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 010A with a grade of C- or better. An introduction to computer organization. Topics include number representation, combinational and sequential logic, computer instructions, memory organization, addressing modes, interrupt, input/output (I/O), assembly language programming, assemblers, and linkers.

Upper-Division Courses

CS 100 Software Construction (5) Lecture, 3 hours; laboratory, 2 hours; discussion, 1 hour; individual study, 1 hour. Prerequisite(s): CS 010C with a grade of C- or better. Emphasizes development of software systems. Topics include design and implementation strategies and selection and mastery of programming languages, environment tools, and development processes. Develops skill in programming, testing, debugging, performance evaluation, component integration, maintenance, and documentation. Covers professional and ethical responsibilities and the need to stay current with technology.

CS 105 Data Analysis Methods (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 009B with a grade of C- or better or CS 010B with a grade of C- or better; restricted to class level standing of sophomore, junior, senior, or masters. An introduction to fundamental concepts and methods in data analysis and visualization essential to a variety of data science tasks. Designed to provide preparation for the data science major and for advanced courses in data analysis and applications of data science.

CS 108 Data Science Ethics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 105 or STAT 107 or CS 171; or consent of instructor. Covers ethics specifically related to data science. Topics include data privacy; data curation and storage; discrimination and bias arising in the machine learning process; statistical topics such as generalization, causality, curse of dimensionality, and sampling bias; data communication; and strategies for conceptualizing, measuring, and mitigating problems in data-driven decision-making. Cross-listed with STAT 108. Credit is awarded for one of the following CS 108, STAT 108, CS 212, or STAT 212.

CS 110 Principles of Web Development (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100. Provides an introduction to distributed systems, with a focus on web development techniques and the considerations to application scalability, security, reliability, and redundancy. Provides an in-depth study of technologies used for both back-end and front-end development, and how to design robust applications in the webs constantly evolving landscape.

CS 111 Discrete Structures (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010A; CS 011 or MATH 011; MATH 009C or MATH 09HC; MATH 031 or EE 020B. A study of discrete mathematical structures emphasizing applications to computer science. Topics include number theory and cryptography, asymptotic notation, recurrence equations, counting methods, elements of graph theory, and trees.

CS 119L Laboratory in Problem Solving and Programming (2) Laboratory, 3 hours; individual study, 3 hours. Prerequisite(s): CS 010C with a grade of C- or better; CS 111 recommended; or consent of instructor. Explores techniques and skills applicable in developing software solutions to real-life algorithmic problems. Emphasizes systematic and rigorous approaches to problem-solving. Covers the end-to-end solution process including formulating models, choosing appropriate algorithmic tools and data structures, designing algorithms, implementation, and testing. Course is repeatable to a maximum of 4 units.

CS 120A Logic Design (5) Lecture, 3 hours; laboratory, 3 hours; individual study, 3 hours. Prerequisite(s): CS 061 with a grade of C- or better. Covers design of digital systems. Includes Boolean algebra; combinational and sequential logic design; design and use of arithmetic logic units, carry-lookahead adders, multiplexors, decoders, comparators, multipliers, flip-flops, registers, and simple memories; state-machine design; and basic register-transfer level design. Uses hardware description languages, synthesis tools, programmable logic, and significant hardware prototyping. Cross-listed with EE 120A.

CS 120B Introduction to Embedded Systems (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010B; CS 120A or EE 120A. Introduction to hardware and software design of digital computing systems embedded in electronic devices (e.g., digital cameras or portable video games). Includes embedded processor programming, custom processor design, standard peripherals, memories, interfacing, and hardware/software tradeoffs. Involves use of synthesis tools, programmable logic, microcontrollers, and developing working embedded systems. Cross-listed with EE 120B.

CS 122A Intermediate Embedded and Real-Time Systems (5) Lecture, 3 hours; laboratory, 6 hours. Prerequisite(s): CS 010B; CS 120B or EE 120B. Covers software and hardware design of embedded computing systems. Includes hardware and software codesign, advanced programming paradigms (including state machines and concurrent processes), real-time programming, operating systems, basic control systems, modern chip, and design technologies. Laboratories involve use of microcontrollers, embedded microprocessors, programmable logic, advanced simulation, and debug environments.

CS 122B Advanced Embedded and Real-Time Systems (5) Lecture, 3 hours; laboratory, 6 hours. Prerequisite(s): CS 122A. Explores state-of-the-art aspects of building embedded computer systems. Topics include real-time programming, synthesis of coprocessor cores, application-specific processors, hardware and software co simulation and codesign, low-power design, reconfigurable computing, core-based design, and platform-based methodology.

CS 130 Computer Graphics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100; MATH 031, may be taken concurrently or EE 020B, may be taken concurrently; or consent of instructor. A study of the fundamentals of computer graphics necessary to design and build graphics applications. Examines raster graphics algorithms including scan-converting graphics primitives, anti-aliasing, and clipping. Also covers geometric transformations, viewing, solid modeling techniques, hidden-surface removal algorithms, color models, illumination, and

shading.

CS 131 Edge Computing (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100 or EE 120B or CS 120B. Covers industry standards for quality of service and security while leveraging performance constraints. Develops skill in deploying real-world applications using embedded artificial intelligence. Cross-listed with EE 131.

CS 133 Computational Geometry (4) Lecture, 3 hours; laboratory, 1 hour; individual study, 2 hours. Prerequisite(s): CS 100, CS 111, MATH 031; or equivalents. An introduction to the design of geometry algorithms. Covers the basic computational geometry concepts and techniques used in graphics, robotics, and engineering design. Topics include polygons and polytopes, convex hulls, and voronoi diagrams.

CS 135 Virtual Reality (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): CS 100. Covers the development of virtual reality (VR) worlds, including motion and physics of VR worlds. Includes design practices for immersive experiences, human visual perception, environmental and social interactions. Also includes positional tracking with sensors, augmented and mixed reality, and storage and transmission of virtual reality worlds.

CS 141 Intermediate Data Structures and Algorithms (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010C with a grade of C- or better; CS 111; MATH 009C or MATH 09HC; proficiency in C++. Explores basic algorithm analysis using asymptotic notations, summation and recurrence relations, and algorithms and data structures for discrete structures including trees, strings, and graphs. Also covers general algorithm design techniques including “divide-and-conquer,” the greedy method, and dynamic programming. Integrates knowledge of data structures, algorithms, and programming.

CS 142 Algorithm Engineering (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100, CS 141; or equivalent. Covers the design and implementation of sequential, parallel, cache-efficient, external-memory, and write-efficient algorithms for fundamental computational problems including sorting, searching, as well as a selection of problems in algebra, geometry, combinatorial optimization, and string processing. Emphasizes practical aspects of algorithm design, efficient implementation, and experimental methodology for performance evaluation.

CS 144 Algorithms For Bioinformatics (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 141. Introduces fundamental algorithms and data structures for solving analytical problems in molecular biology and genomics. Includes exact and approximate string matching; sequence alignment; genome assembly; and gene and regulatory motifs recognition. Credit is awarded for one of the following CS 144, CS 234, or CS 238.

CS 145 Combinatorial Optimization Algorithms (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 141; MATH 031 or MATH 131. The study of efficient algorithm design techniques for combinatorial optimization problems. Topics include shortest paths, minimum spanning trees, network flows, maximum matchings, stable matchings, linear programming, duality, two-person games, algorithmic techniques for integer programming problems, NP-completeness, and approximation algorithms.

CS 147 Graphics Processing Unit Computing and Programming (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): EE 120B or CS 120B. Introduces principles and practices of programming graphics processing units (GPUs) using the parallel programming environment. Covers memory/threading models, common data-parallel programming patterns and libraries

needed to develop high-performance parallel computing applications. Examines computational thinking; a broader range of parallel execution models; and parallel programming principles. Cross-listed with EE 147.

CS 150 Automata and Formal Languages (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 010C with a grade of C- or better; CS 111; MATH 009C or MATH 09HC. A study of formal languages. Includes regular and context-free languages; computational models for generating these languages such as finite-state automata, pushdown automata, regular expressions, and context-free grammars; mathematical properties of the languages and models; and equivalence between the models. Also introduces Turing machines and decidability.

CS 152 Compiler Design (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 061; CS 100; CS 111; CS 150. Covers the fundamentals of compiler design. Includes lexical analysis, parsing, semantic analysis, compile-time memory organization, run-time memory organization, code generation, and compiler portability issues.

CS 153 Design of Operating Systems (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 061; CS 100; CS 111; C++ programming proficiency. Covers the principles and practice of operating system design. Includes concurrency, memory management, file systems, protection, security, command languages, scheduling, and system performance.

CS 160 Concurrent Programming and Parallel Systems (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 061; CS 100; CS 111. A study of concurrent and parallel systems. Topics include modular structure and design, interprocess communication, synchronization, failures, persistence, and concurrency control. Also covers atomic transactions, recovery, language support, distributed interprocess communication, and implementation mechanisms. Provides preparation for the study of operating systems, databases, and computer networking.

CS 161 Design and Architecture of Computer Systems (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): EE 120A or CS 120A. A study of the fundamentals of computer design. Topics include the performance evaluation of microprocessors; instruction set design and measurements of use; microprocessor implementation techniques including multicycle and pipelined implementations; computer arithmetic; memory hierarchy; and input/output (I/O) systems.

CS 161L Laboratory in Design and Architecture of Computer Systems (2) Lecture, 1 hour; laboratory, 3 hours. Prerequisite(s): CS 161 (may be taken concurrently). Covers the design and simulation of a complete computer system using hardware description language and simulator. Topics include instruction set architecture design; assemblers; datapath and control unit design; arithmetic and logic unit; memory and input/output (I/O) systems; and integration of all parts into a working computer system.

CS 162 Computer Architecture (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): CS 161 with a grade of “C-” or better. The study of advanced processor design. Topics include CPU pipelining, data and control hazards, instruction-level parallelism, branch prediction, and dynamic scheduling of instructions. Also covers Very Long Instruction Word (VLIW) processing, multimedia support, design of network and embedded processors, basic multiprocessor design, shared memory and message passing, and network topologies.

CS 164 Computer Networks (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour.

Prerequisite(s): CS 100; CS 111; CS 153. Covers the fundamentals of computer networks. Topics include layered network architecture, communication protocols, local area networks, UNIX network programming, verification, network security, and performance studies.

CS 165 Computer Security (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): CS 141, CS 153. Examines the ways in which information systems are vulnerable to security breaches. Topics include attacks; security labels, lattices, and policies; safeguards and countermeasures; intrusion detection; authorization and encryption techniques; networks; digital signatures, certificates, and passwords; privacy issues, firewalls, and spoofing; Trojan horses and computer viruses; CERT Coordination Center; and electronic commerce.

CS 166 Database Management Systems (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100; CS 111. Covers basic concepts of databases and database management systems. Topics include entity-relationship modeling for design, relational data model, relational algebra, Structured Query Language (SQL), secondary storage, indexing and hashing, query evaluation and optimization, and overview of transactions.

CS 167 Introduction to Big-Data Management (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100, CS 111; CS 167 online section: enrollment in the online Master-of-Science in Engineering program. Introduces the architecture of big-data systems and their applications in data management and processing. Describes the common functionality in big-data processing such as distributed storage, resource management, query processing, fault-tolerance, and programming APIs. Covers the popular big-data technologies such as distributed shared-nothing systems, NoSQL processing model, and semi-structured data management.

CS 168 Introduction to Very Large Scale Integration Design (4) Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): CS 120A or EE 120A; or consent of instructor. Studies integrated circuit fabrication, device characterization, and circuit simulation. Introduces basic device physics and physical design rules, MOS logic design, and timing and clock schemes. Covers layout generation, subsystem designs, and circuits for alternative logic styles. Also covers design and simulation using hardware description language and CAD tools. Cross-listed with EE 168. Credit is awarded for one of the following EE 168, CS 168, or EE 282A.

CS 169 Mobile Wireless Networks (4) Lecture, 3 hours; laboratory, 2 hours; extra reading, 1 hour. Prerequisite(s): CS 153 or consent of instructor. Introduces the fundamentals of wireless and mobile networks. Covers wireless channel models, MAC protocols, and wireless network architectures. Also covers cellular, WLAN and ad hoc networks, and routing in multi-hop wireless networks. Includes wireless security and the impact of wireless links on TCP and other transport layer solutions.

CS 170 Introduction to Artificial Intelligence (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100 with a grade of “C-” or better, CS 111. An introduction to the field of artificial intelligence. Focuses on discrete-valued problems. Covers heuristic search, problem representation, and classical planning. Also covers constraint satisfaction and logical inference.

CS 171 Introduction to Machine Learning and Data Mining (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 010A; MATH 031 or EE 020B; STAT 155 or EE 114 or STAT 156A; CS 100 or EE 016. Introduces formalisms and methods in data mining and machine learning. Topics include data representation, supervised learning, and classification. Covers regression and clustering. Also covers rule learning, function approximation, and margin-based

methods. Cross-listed with EE 142.

CS 172 Introduction to Information Retrieval (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100; CS 111; EE 114 or STAT 155. Introduces information retrieval (IR) principles and techniques for indexing and searching document collections. Topics include Web search, text processing, ranking algorithms, search in social networks, and search evaluation. Also studies scalability issues in search engines. Satisfactory (S) or No Credit (NC) grading is not available.

CS 173 Introduction to Natural Language Processing (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100; CS 111; EE 114 or STAT 155. An overview of modern approaches for natural language processing. Focuses on major algorithms used in NLP for various applications such as part-of-speech tagging, parsing, named entity recognition, coreference resolution, sentiment analysis, and machine translation.

CS 175 Entrepreneurship in Computing (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100; restricted to class level standing of junior, or senior. Introduces business and technological concepts to create companies based on computer technology. Covers technical aspects of real-world IT projects. Includes developing software and services; understanding user requirements; designating usable systems; and assessing technology. Addresses market analysis and strategy; legal and intellectual property; ethics and communication issues; and financial analysis.

CS 177 Modeling and Simulation (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100; CS 111; C++ programming proficiency. Covers validation of random number sequences; concepts in modeling and systems analysis; and conceptual models and their mathematical and computer realizations. Examines simulation modeling techniques including object-oriented modeling and discrete-event modeling. Emphasizes the use of simulation libraries used with programming languages such as C++.

CS 178A Project Sequence in Computer Science and Engineering (4) Lecture, 1 hour; laboratory, 2 hours; individual study, 1 hour; practicum, 6 hours. Prerequisite(s): CS 141, ENGR 180W; restricted to class level standing of senior. Incorporates the proposal, design, building, testing, and documenting of software and hardware devices or systems under the direction of a faculty member. Emphasizes professional and ethical responsibilities and the need to stay current on technology and its global impact on economics, society, and the environment. Completed together, CS 178A and CS 178B may be applied as a substitute for the CS 179 (E-Z) CS major requirement. Graded In Progress (IP) until CS 178A and CS 178B are completed, at which time, a final letter grade is assigned.

CS 178B Project Sequence in Computer Science and Engineering (4) Lecture, 1 hour; laboratory, 2 hours; individual study, 1 hour; practicum, 6 hours. Prerequisite(s): CS 178A; restricted to class level standing of senior. Incorporates the proposal, design, building, testing, and documenting of software and hardware devices or systems under the direction of a faculty member. Emphasizes professional and ethical responsibilities and the need to stay current on technology and its global impact on economics, society, and the environment.

CS 179 (E-Z) Project in Computer Science (4) Prerequisite(s): CS 100 with a grade of C- or better; CS 152 with a grade of C- or better; ENGR 180W. For hours and prerequisites, see segment descriptions. Under the direction of a faculty member, student teams propose, design, build, test, and document software and/or hardware devices or systems. Emphasizes

professional and ethical responsibilities and the need to stay current on technology and its global impact on economics, society, and the environment.

CS 179E Project in Computer Science: Compilers (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100 and CS 152 with grades of "C-" or better; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a compiler-related system. Incorporates techniques from previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

C**S 179F Project in Computer Science: Operating Systems (4)** Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 153 with a grade of "C-" or better; ENGR 180W; 8 additional upper-division units in Computer Science. CS 160 is recommended. Covers the planning, design, implementation, testing, and documentation of an operating systems-related system. Incorporates techniques from previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179G Project in Computer Science: Database Systems (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100 with a grade of C- or better; CS 166 with a grade of C- or better or CS 167 with a grade of C- or better, ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a database-related system. Incorporates techniques from previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179I Project in Computer Science: Networks (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100 and CS 164 with grades of "C-" or better; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a network-related system. Incorporates techniques from previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179J Project in Computer Science: Computer Architecture and Embedded Systems (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100, CS 111, CS 120B/EE 120B, and CS 161 with grades of "C-" or better or consent of instructor; ENGR 180W; 3 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a computer architecture and embedded systems-related system. Incorporates using techniques presented in previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179K Project in Computer Science: Software Engineering (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 180; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a software engineering-related system. Incorporates techniques presented in previous related courses. Emphasizes professional and

ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 179M Project in Computer Science: Artificial Intelligence (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 100, CS 111, and CS 170 with grades of "C-" or better; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of an artificial intelligence-related system. Incorporates techniques presented in previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

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CS 179N Project in Computer Science: Graphics and Electronic Games (4) Discussion, 1 hour; laboratory, 3 hours; research, 3 hours; extra reading, 3 hours. Prerequisite(s): CS 130 with a grade of C- or better; ENGR 180W; 8 additional upper-division units in Computer Science. Covers the planning, design, implementation, testing, and documentation of a graphics or electronic game-related system. Incorporates using techniques presented in previous related courses. Emphasizes professional and ethical responsibilities; the need to stay current on technology; and its global impact on economics, society, and the environment.

CS 180 Introduction to Software Engineering (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100. A study of software engineering techniques for the development, maintenance, and evolution of large software systems. Topics include requirements and specification; system design and implementation; debugging, testing, and quality assurance; reengineering; project management; software process; tools; and environments.

CS 181 Principles of Programming Languages (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 061; CS 100; CS 111; CS 150. Covers the principles of programming language design. Includes the study and comparison of several programming languages, their features, and their implementations.

CS 182 Software Testing and Verification (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 100. A study of modern techniques to assess the quality of software artifacts through functional, performance, and reliability testing. Introduces black box and white box testing techniques. Covers the application of modern testing tools to software units, components, subsystems, and entire systems. Also covers verification as a complementary technique to testing.

CS 183 Unix System Administration (4) Lecture, 3 hours; laboratory, 2 hours; individual study, 1 hour. Prerequisite(s): CS 100. Explores the technical aspects of system administration on a Unix system including advanced Unix. Includes managing system devices, operating system installation, communications, and networking.

CS 193 Design Project (1 to 4) Laboratory, 1 to 6 hours; scheduled research, 1 to 3 hours; individual study, 1 to 3 hours, Prerequisite(s): CS 141; consent of instructor. Individual hardware or software design project to include establishment of objectives and criteria, synthesis, analysis, implementation, testing, and documentation. Course is repeatable to a maximum of 8 units.

ENGR 001M Professional Development and Mentoring (1) Activity, 30 hours per quarter. Prerequisite(s): freshman standing in the Bourns College of Engineering. Provides freshmen

with involvement in professional development activities. Activities to be performed are program-specific, and may include projects, industry overviews and interactions, involvement with professional societies and clubs, team building, career guidance, and coverage of ethics and lifelong learning issues. E. Bioengineering; F. Chemical Engineering; G. Computer Engineering; I. Computer Science; J. Electrical Engineering; K. Environmental Engineering; M. Computer Science with Business Applications.

ENGR 101M Professional Development and Mentoring (1) Activity, 30 hours per quarter. Prerequisite(s): restricted to class level standing of junior; restricted to major(s) Bioengineering, Bioengineering BS + MS, Chemical Engineering, Chemical Engineering BS + MS, Computer Engineering, Computer Science, Computer Science BS + MS, Electrical Engineering, Electrical Engineering BS + MS, Environmental Engineering, Environmental Engr BS + MS, Materials Science and Engineer, Mechanical Engineering, Mechanical Engineering BS + MS. Provides opportunities with involvement in professional development activities. May include projects, industry overviews and interactions, involvement with professional societies and clubs, team building, career guidance, and coverage of ethics and lifelong learning issues. E. Bioengineering; F. Chemical Engineering; G. Computer Engineering; I. Computer Science; J. Electrical Engineering; K. Environmental Engineering; M. Computer Science With Business Applications.

ENGR 180W Technical Communications (4) Lecture, 3 hours; workshop, 3 hours. Prerequisite(s): ENGL 001B with a grade of C or better, ENGL 007, may be taken concurrently; for concurrent enrollment in ENGL 007, review the course titles or topics in the current online Schedule of Classes to find the corresponding ENGL 007 writing workshop; restricted to class level standing of junior, or senior. Develops oral, written, and graphical communication skills. Includes preparing and critiquing reports, proposals, instructions, and business correspondence. Emphasizes professional and ethical responsibilities and the need to stay current on technology and its global impact on economics, society, and the environment. Fulfills the third-quarter writing requirement for students who earn a grade of "C" or better for courses that the Academic Senate designates, and that the student's college permits, as alternatives to English 001C.

MATH 009A First-Year Calculus (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 005A with a grade of C- or better or MATH 006B. Introduction to the differential calculus of functions of one variable. Credit is awarded for one of the following MATH 009A, MATH 005B, MATH 007A, or MATH 09HA.

MATH 009B First-Year Calculus (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 005B with a grade of C- or better or MATH 009A or MATH 09HA. Introduction to the integral calculus of functions of one variable. Credit is awarded for one of the following MATH 009B, MATH 005C, MATH 007B, or MATH 09HB.

MATH 009C First-Year Calculus (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009B with a grade of “C-” or better or MATH 09HB with a grade of “C-” or better. Further topics from integral calculus, improper integrals, infinite series, Taylor’s series, and Taylor’s theorem. Credit is awarded for only one of MATH 009C or MATH 09HC.

MATH 031 Applied Linear Algebra (5) Lecture, 3 hours; discussion, 2 hours. Prerequisite(s): CS 010A with a grade of C- or better or MATH 005C with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 09HB with a grade of C- or better. A study of matrices and systems of linear equations, determinants,

Gaussian elimination, vector spaces, linear independence and linear transformation, orthogonality, eigenvalues, and eigenvectors. Also examines selected topics and applications. Credit is awarded for one of the following MATH 031 or EE 020B.

STAT 155 Probability and Statistics for Science and Engineering (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009C, may be taken concurrently or MATH 09HC, may be taken concurrently. Covers sample spaces and probability; random variables and probability distributions; elements of statistical inference; and testing and estimation. Also addresses selected topics in multivariate distributions and introduces stochastic processes. Credit is not awarded for STAT 155 if it has already been awarded for STAT 156A or STAT 160A.

STAT 156A Mathematical Statistics with Applications for Data Science I (4) -- *new course*-- Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009C or consent of instructor. Introduction to frequentist probability concepts, random variables, and their distributions. Discussion of key theorems and inequalities in probability theory. Introduction to frequentist methods of point and interval estimation.

STAT 160A Elements of Probability and Statistical Theory (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): MATH 009C, may be taken concurrently or MATH 09HC, may be taken concurrently. Topics include statistical regularity, probability spaces, fundamental theorems in discrete probability, Bayes' theorem, random variables, densities and distribution functions, and continuous distributions. Credit is awarded for one of the following STAT 160A or STAT 156A.

PSYCHOLOGY CONCENTRATION

PSYC 001 Introductory Psychology 4 Lecture, 3 hours; discussion, 1 hour. An introduction to psychology as an experimental science. Emphasizes topics in cognitive (including learning, memory, sensation, perception), comparative, and physiological psychology.

PSYC 002 Introductory Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): none. Emphasizes topics in developmental psychology, tests and
measurements, social psychology, personality,
and abnormal behavior.

PSYC 011 Psychological Methods: Statistical Procedures 5 Lecture, 3 hours; discussion, 2 hours. Prerequisite(s): MATH 004 with a grade of C- or better or MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 09HA with a grade of B or better or MATH 009B with a grade of C- or better or MATH 09HB with a grade of B or better or MATH 009C with a grade of C- or better or MATH 09HC with a grade of B or better or MATH 010A with a grade of C- or better or MATH 010B with a grade of C- or better or MATH 022 with a grade of C- or better; PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; or a score on the Math Advisory Exam sufficient for placement into MATH 022 or higher. Covers descriptive and inferential statistics, measures of central tendency, variability, and correlation. Introduces sampling distributions, statistical inference, and hypothesis testing.

PSYC 012 Psychological Methods: Research Procedures 6 Lecture, 3 hours; laboratory, 3 hours; research, 3 hours; term paper, 1 hour; extra reading, 2 hours. Prerequisite(s): ENGL

001B with a grade of C or better; PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; MATH 004 with a grade of C- or better or MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 09HA with a grade of B or better or MATH 009B with a grade of C- or better or MATH 09HB with a grade of B or better or MATH 009C with a grade of C- or better or MATH 09HC with a grade of B or better or MATH 010A with a grade of C- or better or MATH 010B with a grade of C- or better or MATH 022 with a grade of C- or better; or equivalent; a score on the Math Advisory Exam sufficient for placement into MATH 022 or higher; consent of instructor is required for students repeating the course. A systematic survey of research methodologies in psychology. Laboratory assignments include evaluating and testing psychological theories; assessing methodologies and research designs; designing and implementing research; collecting data and analyzing statistics; writing research reports; and discussing ethical issues in science.

CBNS 106 Introduction to Neuroscience 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A and BIOL 005B with grades of "C-" or better, CHEM 001A, CHEM 001B, CHEM 001C; or consent of instructor. An introduction to cellular, organismal, and behavioral neuroscience for science majors. Topics include structure and functions of the brain, neurons, and synapses; sensory systems and perception; control of movement; neurobiology of hormones and sexual behavior; biorhythms; learning; memory; and psychoses.

PSYC 109 Advanced Research Methods 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012, each with a grade of “B-” or better; or equivalents; or consent of instructor. Advanced theory and practice of planning, conducting, reporting, and evaluating research in the social and behavioral sciences. Students conduct original research that, if desired, can lead to (and become part of) a senior honors thesis or other senior-level research project. Satisfactory (S) or No Credit (NC) grading is not available.

PSYC 110 The Brain and Behavior 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of “C-” or better, or equivalents, or consent of instructor. Explores the principles of neuroanatomy and neurophysiology and their relationship to brain function. Topics include sensory and perceptual processes, biological aspects of learning and memory, motivation, emotion, language, and abnormal behavior.

PSYC 112 Neural Mechanisms of Animal Behavior 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 with a grade of “C-” or better or PSYC 110 with a grade of “C-” or better or consent of the instructor. Studies how the nervous systems of vertebrates and invertebrates contribute to and control their behavior. Focuses on aspects of sensory physiology with a brief orientation to the structure and function of nervous systems. Emphasizes a top-down approach to neurobiology, with specific behaviors providing guidelines for an examination of neural mechanisms.

PSYC 113 Pandemic Biopsychology: From Virus to Vaccine 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of C- or better, PSYC 002 with a grade of C- or better, PSYC 011 with a grade of C- or better, PSYC 012 with a grade of C- or better; or consent

of instructor. Explores pandemics through analyses of historical events, scientific research investigating viruses related to global outbreaks, human immune response to infection, and how different vaccines (adenovirus, mRNA) are created and function in human systems. Also examines how pandemics impact people's sense of security, mental health, and personal well-being.

PSYC 115 Drugs and Behavior 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 with a grade of "C-" or better or PSYC 110 with a grade of "C-" or better or consent of instructor. Describes both legal and illegal drugs. Analyzes drug-nervous system interactions and how the use of various drugs (particularly drugs of abuse) affects behavior and psychological well-being.

PSYC 117 Cognitive Neuroscience of Memory and Consciousness 4 Seminar, 3 hours; extra reading, 3 hours. Prerequisite(s): CBNS 106 with a grade of "C-" or better or PSYC 110 with a grade of "C-" or better. Surveys the neural basis of mental processes, focusing on memory and consciousness and their behavioral manifestations. Emphasizes current research literature.

PSYC 120 Cellular Neuroscience: Membrane and Synaptic Phenomena 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or consent of instructor. An examination of cellular and molecular mechanisms of nervous system function using concepts drawn from the study of vertebrates and invertebrates with emphasis on mammalian systems. Cross-listed with CBNS 120.

PSYC 121 Developmental Neuroscience 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or consent of instructor. A study of the development of nervous systems. Examines the cellular and molecular mechanisms of neural development and the determinants of cell birth and death, axonal pathfinding, neuronal connections, and development of neural systems underlying behavior. Cross-listed with CBNS 121.

PSYC 122 Human Neuroimaging 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 110 or CBNS 106 or consent of instructor. PSYC 122 can be taken without PSYC 122L. An introduction to magnetic resonance imaging in psychological research with an emphasis on the merits and limitations of structural and functional neuroimaging in humans.

PSYC 126 Neuroscience of Learning and Memory 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CBNS 106 or PSYC 110; or consent of instructor. Covers mechanisms of learning and memory across levels of analysis including genetic, neuronal, systems, and theory. Topics include the multiple memory systems, memory consolidation, working memory, emotional memory, recognition memory, spatial memory, and human amnesia. Cross-listed with CBNS 126.

PSYC 128 Language and the Brain 4 Lecture, 3 hours; research, 2 hours; extra reading, 2 hours. Prerequisite(s): LING 020 or PSYC 110 or PSYC 135 or CBNS 106; or consent of

instructor. Interdisciplinary introduction to the study of language and the brain. Includes brain evolution for language, neural bases for language production and language comprehension, aphasiology and language disorders, and additional special topics. Cross-listed with LING 162.

PSYC 129 Human Neuropsychology 4 Lecture, 3 hours; discussion, 1.5 hours. Prerequisite(s): a grade of "C-" or better in one of the following courses or consent of instructor: CBNS 106, PSYC 110, PSYC 132, PSYC 134, PSYC 135. Surveys how high psychological functions (e.g., perception, memory, language) are organized in the human brain. Special emphasis is on behavioral and cognitive impairments due to brain injury and how they may inform our view of normal cognitive functions.

PSYC 130 Fundamentals of Learning and Conditioning 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. A survey course that includes both historical and current models of human learning, conditioning, and memory. Provides a good foundation for research or future study in learning and memory by covering fundamental theories established by Pavlov and Skinner while incorporating new theories of human behavioral control.580 |

PSYC 131 Computational and Mathematical Models in Cognitive Science 4 Lecture, 3 hours; extra reading, 1.5 hours; written work, 1.5 hours. Prerequisite(s): a grade of "C-" or better in PSYC 001, PSYC 002, PSYC 011, PSYC 012 or consent of instructor. Introduces students to the technical and theoretical issues involved in using models to understand behavior. Involves analysis of model predictions and simulation of behavioral data. Course is repeatable to a maximum of 12 units if taken with different instructors.

PSYC 132 Perception 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. An analysis of the role played by sensory mechanisms, experiences, expectations, and needs in recognizing objects in the environment.

PSYC 133 Human Factors 4 Lecture, 3 hours; extra reading, 3 hours; term paper, 1 hour. Prerequisite(s): a grade of "C-" or better in one of the following courses or consent of instructor: PSYC 132 or PSYC 134. Provides an overview of the human capabilities and limitations considered in the design of personmachine systems. Evaluates factors critical to performance in person-machine systems, including attention, decision making, motor performance, and memory.

PSYC 134 Cognitive Processes 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; PSYC 012 with a grade of C- or better; or consent of instructor. Addresses empirical and theoretical research in several subareas within contemporary cognitive psychology. Subareas include attention, mental representation, information organization and retrieval from memory, psycholinguistics, problem solving, decision making, thinking, and artificial intelligence and computer simulation of cognitive processes.

PSYC 135 Psycholinguistics 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): a grade of "C-" or better in the following courses or consent of instructor: PSYC 001, PSYC 002, PSYC 011, PSYC 012. Introduction to psycholinguistics emphasizing the psychological implications of linguistic theory, including the effect of syntactic structure on the comprehension, production, and retention of speech; the course of language acquisition; and models of the adult language user.

PSYC 140 Social Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. The relationship between the individual and the group, including such topics as conformity and deviance, attraction and prejudice, altruism and aggression, and the social nature of attitudes.

PSYC 142 Industrial/Organizational Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 002. Introduction to the field of industrial/organizational psychology covering fundamental theory and research in personnel and organizations. Topics include employee selection and training, performance appraisal, motivation, organizational dynamics, leadership, and job satisfaction.

PSYC 148 Topics in Social Psychology 4 Lecture, 3 hours; extra reading or term paper, 3 hours. Prerequisite(s): a grade of "C-" or better in the following courses or consent of instructor: PSYC 001, PSYC 002, PSYC 011, PSYC 012, PSYC 140. Intensive study of selected topics in social psychology such as race relations, attitude formation and change, biases of social science researchers, and the application of psychological principles in community organization. Emphasis is on the study of these areas in natural settings. Specific course content varies. Course is repeatable to a maximum of 16 units.

PSYC 149 The Science of Well-Being 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 and PSYC 002. Covers current theory and research in positive psychology and the scientific study of optimal human functioning. Topics include the causes and benefits of happiness; how happiness can be measured and increased; positive emotions; flow; and human strengths and virtues including optimism, love, altruism, forgiveness, and gratitude.

PSYC 152 Abnormal Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. An introduction to the research and theories regarding the major types of abnormal behavior, including the neuroses, schizophrenia, psychosomatic disorders, sexual disorders, drug and stress induced states, and organic disorders.

PSYC 153 Introduction to Clinical Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): a grade of "C-" or better in the following courses or consent of instructor: PSYC 001, PSYC 002, PSYC 011, PSYC 012, PSYC 152. Introduction to the field of clinical psychology. Emphasizes the application and evaluation of techniques of individual and group counseling and therapy. Also addresses the application and evaluation of psychological tests in the assessment of psychological problems.

PSYC 155 Personality Assessment 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): a grade of "C-" or better in the following courses or consent of instructor: PSYC 001, PSYC 002, PSYC 011, PSYC 012, PSYC 150. Covers the assessment of personality through self-report tests, projective tests, and systematic observations. Also entails descriptions of the psychometrics of testing as it applies to the problems in studying personality.

PSYC 160 Life Span Development 5 Lecture, 3 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; PSYC 012 with a grade of C- or better. Introduces the biological, social, and cognitive processes that influence development from the prenatal period through late adulthood. Topics include development in physical, motor, perceptual, cognitive, emotional, and social areas. Includes discussion of issues related to intellectual functioning, personality, social roles and relationships, coping and adjustment, and aging.

PSYC 161 Socioemotional and Personality Development 5 Lecture, 3 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; PSYC 012 with a grade of C- or better; or consent of instructor. A study of the development of human personality from birth through late adolescence. Emphasizes the impact of interpersonal relationships on the acquisition of human traits, emotional reactions, and patterns of adjustment.

PSYC 162 Biological Issues in Development 5 Lecture, 3 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, and PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. Examines biological processes that influence behavior and development across the life span. Discusses contemporary theoretical approaches to the study of biological, genetic, and environmental influences on development. Topics include behavioral genetics, developmental neuroscience, and the impact of early environments and stress on adaptation and resilience.

PSYC 163 Cognitive Development 5 Lecture, 3 hours; discussion, 1 hour; term paper, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, and PSYC 012 with grades of "C-" or better; or equivalents; or consent of instructor. An analysis of intellectual development from birth through maturity and into stages of aging. Discusses historical and contemporary theoretical and experimental approaches to studying the mechanisms of intellectual growth and development.

PSYC 164 Emotional and Behavioral Disorders of Childhood 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012, PSYC 152, and PSYC 160 with grades of C- or better; or equivalents; or consent of instructor. Provides an overview of behavioral and emotional disorders affecting children and adolescents within a developmental context. Examines disorders affecting youth in terms of prevalence, developmental course, and theories. Topics include theoretical models of child psychopathology; diagnostic, assessment, and treatment practices; and the descriptive psychopathology of major childhood disorders.

PSYC 165A The Cultural Bases of Human Development 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, and PSYC 012 with grades of “C-” or better; or equivalents; or consent of instructor. Examines the social, emotional, and intellectual aspects of human development from a cultural perspective. Covers theory, research, and methods of studying the cultural bases of psychological growth. Topics include socialization practices, parenting, social relations, language and cognition, schooling and academic achievement, acculturation, and ethnicity.

PSYC 165B The Development of Immigrant and Ethnic Minority Youth 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012, and PSYC 160 with grades of “C-” or better; or equivalents; or consent of instructor. Covers current theory and research on the development of immigrant and ethnic minority youth in the United States. Focuses on the social, cultural, and psychological processes influencing the biological, cognitive, and social development of youth from immigrant and ethnic minority families.

PSYC 166A Infancy 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 all with grades of “C-” or better; or consent of instructor. Covers current theory and research on development during the period of infancy. Addresses the key biological, cognitive, emotional, and social developments during this period.

PSYC 166B Childhood 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 all with grades of “C-” or better; or consent of instructor. Covers current theory and research on development during the period of childhood. Addresses the key biological, cognitive, emotional, and social developments during this period.

PSYC 166C Adolescence and Emerging Adulthood 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of C- or better; PSYC 002 with a grade of C- or better; PSYC 011 with a grade of C- or better; PSYC 012 with a grade of C- or better. Covers current theory and research on development during the period of adolescence and the transition to adulthood. Addresses the key biological, cognitive, emotional, and social developments during this period.

PSYC 166D Adulthood and Aging 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012 all with grades of “C-” or better; or consent of instructor. Covers current theory and research on development during the period of adulthood and the process of aging. Addresses the key biological, cognitive, emotional, and social developments during this period.

PSYC 167 Psychological Development of Black Children 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 002. This course will analyze both the traditional theoretical approaches to the study of Black children and innovative approaches that are currently being developed by Black psychologists. The course will cover topics in the areas of cognitive, social, and personality development. Cross-listed with ETST 167.

PSYC 168 Psychological Aspects of the Black Experience 4 Lecture, 3 hours; extra reading,

3 hours. Prerequisite(s): PSYC 002. This course examines the interdependence between personal characteristics, Afro-American culture, and the social conditions which foster the Black experience. Group membership, life styles, role factors, and situational settings as social norms will be explored in order to understand the uniqueness of the Black experience. Cross-listed with ETST 168.

PSYC 169 Topics in Developmental Psychology 4 Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): PSYC 001 with a grade C- or better; PSYC 002 with a grade C- or better; PSYC 011 with a grade C- or better; PSYC 012 with a grade C- or better; PSYC 160 with a grade C- or better or PSYC 161 with a grade C- or better or PSYC 162 with a grade C- or better or PSYC 163 with a grade C- or better. Intensive study in developmental psychology. Stresses literature, methodology, and experimental design and analysis. Specific course content varies. Course is repeatable to a maximum of 16 units as topics change.

PSYC 171 Psychology of Gender 4 Seminar, 3 hours; term paper, 3 hours. Prerequisite(s): PSYC 012 with a grade of “C-” or better or consent of instructor. Examines psychological theory and research on gender, including ethnic and cultural variations in male and female experience. Topics include gender roles, gender development, gender differences and stereotypes, biological influences on gender, gender and health, gender and language, gender and achievement, and men and women in the workplace.

PSYC 175 Psychology and Law 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 001 with a grade of C- or better, PSYC 002 with a grade of C- or better or LWSO 100 with a grade of C- or better or LWSO 100H with a grade of B or better. A study of psychological theory and empirical research as it relates to the law. Topics include jury decision making, eyewitness memory, child custody, criminal responsibility and intent, competence, rehabilitation and punishment, ethics and legal responsibilities in therapy, and psychological research.

PSYC 178 Health Psychology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PSYC 002 or SOC 001 or SOC 001H. An examination of the importance of interpersonal relationships to physical health and effective medical care. Applies social psychological perspectives to such topics as stress-related diseases, placebo effects, doctor-patient interactions, dying, and the hospital environment.

PSYC 179 Health and Behavior Change 4 Lecture, 3 hours; discussion, 1 hour; term paper, 1 hour. Prerequisite(s): PSYC 002 with a grade of C- or better or PSYC 178 with a grade of C- or better. Examines psychological constructs in health behavior change. Covers theories and research on preventive health behavior; adherence to treatment; health lifestyles; substance use and abuse; and anxiety and depression in medical illness. Also examines cognitive and behavioral techniques; helping skills; placebo effect; social support; therapeutic communication; medical care; and ethical issues.

PSYC 181 Laboratory in Cognitive Psychology 4 Lecture, 3 hours; research, 1.5 hours; extra reading, 1.5 hours. Prerequisite(s): PSYC 001, PSYC 002, PSYC 011, PSYC 012, and PSYC 134 with grades of “C-” or better Integrates the conceptual and theoretical foundations of

cognitive psychology with the mechanics of conducting research. Students develop and design research studies and collect, analyze, and interpret data.

BUSINESS CONCENTRATION

BUS 010 Introduction to Business 4 Lecture, 3 hours, discussion, 1 hour. Prerequisite(s): none. Provides an overview of the field of business administration. Explores business goals and strategies, functional areas of business and their integration in policy and decision making, social responsibility, computers in business, and business trends and challenges including the international dimension.

BUS 020 Financial Accounting and Reporting 4 Lecture, 3 hours, discussion, 1 hour. Prerequisite(s): none. A study of the concepts and techniques for measurement and communication of financial information. Includes interpretation of financial statements.

BUS 101 Information Technology Management 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 008; BUS 020; ECON 003; STAT 008; or equivalent; or consent of instructor. Topics include computer hardware and software, business data processing, databases, telecommunications, systems analysis and design, cost-benefit analysis, and systems applications in business. Includes database and spreadsheet projects.

BUS 102 – Ethics and Law in Business and Society 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003; STAT 008; or equivalent; or consent of instructor. Analyzes the legal, ethical, political, and social aspects of the business environment. Topics include ethics and social responsibility, government regulation, corporate governance, and global management issues.

BUS 103 Marketing and Distribution Management 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003 or ECON 003H, STAT 008; or consent of instructor. An introduction to the role of marketing in society emphasizing concepts, marketing methods, and institutions.

BUS 104 Decision Analysis and Management Science 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): CS 008; STAT 008 or STAT 010; or equivalents; or consent of instructor. A survey of deterministic and probabilistic models for decision making. Topics include linear programming and extensions, networks, dynamic programming, decision trees, queuing models, and simulation. Explores the application of these models in decision making. Cross-listed with STAT 104.

BUS 105 Production and Operations Management 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): STAT 008 or STAT 010; or equivalent. Addresses the issues of design and control of production systems in manufacturing and service organizations. Covers product and process selection, capacity planning, location and layout design, project and job scheduling, inventory control, material planning, and quality control.

BUS 106 Introduction to Financial Management 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003 or ECON 003H; STAT 008 or ECON 101; or equivalent; or consent of instructor. An introduction to financial management and financial institutions. Includes

time value of money, stock and bond valuation, risk and return, portfolio theory, capital budgeting, capital structure, dividend policy, and financial databases. Cross-listed with ECON 134. Credit is awarded for one of the following BUS 106, ECON 134, or BUS 133.

BUS 107 Organizational Behavior 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003; STAT 008; or equivalent; or consent of instructor. Studies organizations from the behavioral science perspective. Topics include motivation, leadership, communication, groups, organization structure and culture, and control in complex organizations.

BUS 108 Financial Evaluation and Managerial Analysis (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 020; ECON 003; STAT 008; or equivalents; or consent of instructor. A study of accounting data used for managerial planning and controlling of business operations. Provides an introduction to manufacturing operations and cost accounting systems, cost-volume-profit analysis, relevant costing, standard costing and variance analysis, and budgeting.

BUS 109 Competitive and Strategic Analysis 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BUS 100W; BUS 103; BUS 108; BUS 106 or ECON 134 or BUS 133; restricted to major(s) Business Administration. Provides an understanding of strategic decision- making processes in organizations, the interrelationships among functional areas, and how decision making is affected by internal and external environments.

BUS 110 Introduction to Data Mining and Visual Analytics 2 Lecture, 2 hours; laboratory, 1 hour; extra reading, 2 hours; written work, 3 hours. Prerequisite(s): BUS 101. Covers the processes, methodologies and practices used to transform data into useful information to support business decision-making. Offers an opportunity to gain insights and hands-on-experience with basic functionality of industry standard data mining and visualization software tools such Tableau, JMP and IBM's Watson Analytic.

BUS 115 Marketing Research 4 Lecture, 3 hours; research, 3 hours. Prerequisite(s): BUS 103. Covers types and sources of marketing information, the marketing research process, and techniques of data collection and analysis, including consumer and customer surveys and test marketing. Examines both quantitative and qualitative research with analysis of the values and limitations of data. Emphasis is placed on evaluation and interpretation of results.

BUS 119 Data-driven Marketing 4 Lecture, 3 hours; individual study, 2 hours; extra reading, 1 hour. Prerequisite(s): BUS 103; or consent of instructor. Examines marketing cases and develops data analytical skills for managerial decision making. Utilizes statistical software to manage, display, and analyze marketing information including consumer survey, relationship management, scanner, and socioeconomic data. Topics include attitude measurement, market segmentation and targeting, competition analysis, market performance analysis, and store location choice.

BUS 123 Spreadsheet Modeling for Decision-Making 4 Lecture, 3 hours; written work, 3 hours. Prerequisite(s): BUS 104 or STAT 104. Introduces the fundamental techniques of using data to make informed management decisions in the presence of uncertainty. Utilizes advanced Microsoft Excel functionality.

BUS 124A Business Analytics 4 Lecture, 3 hours; term paper, 1 hour; written work, 2 hours. Prerequisite(s): STAT 008. Provides fundamental concepts and tools needed to understand the emerging role of business analytics in organizations. Applies basic business analytics tools in a

spreadsheet environment. Introduces market-leading techniques that help identify and manage key data from business processes. Provides the essential tools required for data mining and business process re-engineering.

BUS 124B Advanced Business Analytics 4 Lecture, 3 hours; written work, 3 hours. Prerequisite(s): BUS 124A with a grade of C- or better; STAT 008 or STAT 010; CS 008. Teaches statistical methods for descriptive, predictive, and prescriptive analysis. Provides opportunities to apply these acquired skills in various business applications in operations, finance, and marketing. Utilizes tools such as R Programming for data analysis and Tableau for data visualization.

BUS 125 Simulation for Business 4 Lecture, 3 hours; extra reading, 1.5 hours; outside projects, 1.5 hours. Prerequisite(s): BUS 104 or STAT 104; or equivalents. Introduces simulation as a tool for analyzing complex systems. Analyzes and discusses the theory and practice of modeling through simulation. Topics include modeling uncertainty and collecting input data, Monte Carlo simulation techniques, model verification and validation, and sensitivity analysis. Examines applications in finance, marketing, operations, and supply chain management.

BUS 128 Project Planning and Control (4) Lecture, 3 hours; assigned problems and field project, 3 hours. Prerequisite(s): BUS 104/STAT 104 or consent of instructor. Covers issues related to planning and control. Explores the differences between projects and production systems; breakdown structures of project organization and work; sequencing and budgeting; resource management; project evaluation and control; and use of current project management software. Includes application of methodology to a real-world project.

BUS 129 Supply Chain Management 4 Lecture, 3 hours; assigned problems, 3 hours. Prerequisite(s): BUS 105. Focuses on management of the distribution of goods and services from plants, ports, and vendors to customers. Key topics include transportation, inventories, warehousing, materials handling, order processing, packaging, pricing, customer service standards, and warehouse and retail location.

BUS 130 Supply Chain Modeling 4 Lecture, 3 hours; homework problems and preparation for presentations, 3 hours. Prerequisite(s): BUS 104/STAT 104 or BUS 105. Covers the modeling and analysis of decision problems in supply chain management. Includes logistics network design, integration of supply chain operations, and supply and sourcing decisions. Utilizes the electronic spreadsheet as the principal device for building models, as well as addresses the concepts of effective spreadsheet design and use.

BUS 171 Systems Analysis and Design 4 Lecture, 3 hours; extra reading, 2 hours; projects, 1 hour. Prerequisite(s): BUS 101 or equivalent. Involves detailed analysis, specification, design, and implementation of computer-based information systems. Includes economic analyses, evaluation of alternatives, analysis or design tools, and systems project management and planning. Case studies are used.

BUS 172 Information Economics 4 Lecture, 3 hours; assigned cases and project, 3 hours. Prerequisite(s): BUS 103; ECON 003 or ECON 003H. Discusses economic concepts and strategies related to the network economy. Topics include economic issues surrounding information goods, competition in electronic business, pricing strategies, and intellectual property protections. Examines business strategies for the information (software) and infrastructure (hardware) elements of electronic business.

BUS 173 Introduction to Databases For Management 4 Lecture, 3 hours; extra reading, 2 hours; projects, 1 hour. Prerequisite(s): BUS 101 or equivalent. Covers physical and conceptual aspects of database management systems, including familiarity with the variety of database systems based on different data models. Examines the role of database systems in management information systems (MIS) and issues in database design for effective support of MIS. Requires the use of a database package.

BUS 174 Electronic Commerce (4) Lecture, 3 hours; extra reading, 2 hours; project, 1 hour. Prerequisite(s): BUS 101. Reviews the technological evolution of electronic commerce (EC). Investigates how EC can be used to interact with customers, other organizations, and those within the organization. Studies technical innovations, provides a critical evaluation of strategies, and examines current applications and their impact on the business environment.

BUS 175 Business Data Communications (4) Lecture, 3 hours; extra reading, 3 hours. Prerequisite(s): BUS 101. Surveys components of telecommunication systems; examines major design and analysis issues in the development and implementation of computer communication systems. Studies both voice and data communication systems including local area networks, wireless systems, satellite systems, and distributed computer and database systems. Emphasizes evaluation of these systems for business purposes.

BUS 179 Business Application of Geographic Information Systems (4) Lecture, 2 hours; laboratory, 1 hour; extra reading, 2 hours; written work, 3 hours. Prerequisite(s): BUS 101. Includes introduction to and use of geographic information system (GIS) for business applications. Provides basic understanding on how location information is used in business processes for decisions. Offers an opportunity to gain hands-on experience with basic functionality of industry standard business mapping software tools including ArcGIS and Business Analyst Online.

ECON 002 Introduction to Macroeconomics (5) Lecture, 3 hours; discussion, 1 hour; written work, 3 hours. Prerequisite(s): none. An introduction to the study of the economic system from a macro, or aggregate, perspective. Includes analysis of business cycles, economic growth, unemployment, inflation, and the impact of government policies on the level of economic activity. Credit is awarded for one of the following ECON 002 or ECON 002H.

ECON 003 Introduction to Microeconomics 5 Lecture, 3 hours; discussion, 1 hour; written work, 3 hours. Prerequisite(s): none. An introduction to the study of the economic system from the micro, or individual decision-maker's, perspective. Includes the study of opportunity cost, markets, consumption, production and competition. Credit is only awarded for one of ECON 003 or ECON 003H.

ECON 101 Statistics For Economics 5 Lecture, 3 hours; discussion, 1 hour; laboratory, 1 hour; individual study, 2 hours. Prerequisite(s): MATH 007A or MATH 009A or MATH 09HA or MATH 022; or equivalent. An introduction to the basic statistical methods for economics. Topics include economic data analysis, index numbers, univariate and bivariate probability distributions, correlation and regression, sampling distributions, properties of estimators, and hypothesis testing.

STAT 008 Statistics For Business 5 Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): CS 008 or CS 009A or CS 010A; MATH 004 or MATH 005A or MATH 006B or MATH 007A or MATH 009A or MATH 09HA or MATH 022; or equivalent. An introduction to statistics using business applications. Topics include descriptive statistics; probability; discrete and continuous distributions; Bayes' theorem; random variables; estimation and confidence intervals; hypothesis testing; and simple linear regression. Credit is awarded for one of the following STAT 008 or STAT 010.

STAT 010 Introduction to Statistics 5 Lecture, 3 hours; discussion, 1 hour; laboratory, 3 hours. Prerequisite(s): MATH 005A or MATH 006B or MATH 007A or MATH 009A or MATH 09HA. A general introduction to descriptive and inferential statistics. Topics include histograms; descriptive statistics; probability; normal and binomial distributions; sampling distributions; hypothesis testing; and confidence intervals. Credit is awarded for one of the following STAT 010 or STAT 008.

SOC 150 The Sociology of Economic Organizations (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): upper-division standing or consent of instructor. Examines how the scope and nature of formal and informal organizations are shaped by sociological processes external to them, such as the influence of governments, institutions, networks, and resources. Illustrates the processes with examples from contemporary United States and from other periods and cultures.

PRE-MEDICINE CONCENTRATION

BIOL 005A Introduction to Cell and Molecular Biology (4) Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 05LA (may be taken concurrently) or BIOL 020 (may be taken concurrently) with grades of “C-” or better; CHEM 001A and CHEM 01LA with grades of “C-” or better or CHEM 01HA and CHEM 1HLA with grades of “C-” or better; consent of instructor is required for students repeating the course. An intensive course designed to prepare for upper-division courses in cell and molecular biology. Covers biochemical, structural, metabolic, and genetic aspects of cells. Required for Biology majors; recommended for science majors desiring an introduction to biology.

PHYS 02HLA Honors Genereal Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 02HA; MATH 007A with a grade of B- or better or MATH 009A with a grade of B- or better or MATH 09HA with a grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 02LA. Illustrates the experimental foundations of physics presented in PHYS 02HA. Covers the basic principles of classical mechanics. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HLA or PHYS 02LA.

PHYS 02HLB Honors General Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 02HB; MATH 007B with a grade of B- or better, may be taken concurrently or MATH 009B with a grade of B- or better, may be taken concurrently or MATH 09HB with a grade of B- or better, may be taken concurrently; PHYS 02HA with a grade of B- or better or PHYS 002A with a grade of B- or better; PHYS 02HLA with a grade of B- or better or PHYS 02LA with a grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 02LB. Illustrates the experimental foundations of physics presented in PHYS 02HB. Topics include fluids and fluid flow, thermodynamics, mechanical oscillations, sound and light waves, geometrical optics, reflection, refraction, lens, microscopy, interference, and diffraction. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HLB or PHYS 02LB.

PHYS 02HLC Honors General Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 02HC; PHYS 002B with a grade of B- or better or PHYS 02HB with a grade of B- or better; PHYS 02LB with a grade of B- or better or PHYS 02HLB with a

grade of B- or better; admission to University Honors. Honors course corresponding to PHYS 02LC. Illustrates the experimental foundations of physics presented in PHYS 02HC. Covers electromagnetism and quantum physics. Includes Coulomb's Law, electric field, electrical potential, resistors, capacitors, simple circuits, magnetic forces, and Faraday's Law. Also addresses basic quantum physics of light, atoms, and radioactivity. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following PHYS 02HLC or PHYS 02LC.

PHYS 02LA General Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 002A; MATH 007A with a grade of C- or better or MATH 009A with a grade of C- or better, MATH 09HA with a grade of C- or better. Illustrates the experimental foundations of physics presented in PHYS 002A. Covers the basic principles of classical mechanics. Credit is awarded for one of the following PHYS 02LA or PHYS 02HLA.

PHYS 02LB General Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 002B; MATH 007B, may be taken concurrently or MATH 009B, may be taken concurrently or MATH 09HB, may be taken concurrently; PHYS 002A with a grade of C- or better or PHYS 02HA with a grade of C- or better; PHYS 02LA with a grade of C- or better or PHYS 02HLA with a grade of C- or better. Illustrates the experimental foundations of physics presented in PHYS 002B. Topics include fluids and fluid flow; thermodynamics; mechanical oscillations; sound and light waves; geometrical optics; reflection; refraction; lens; microscopy; interference; and diffraction. Credit is awarded for one of the following PHYS 02LB or PHYS 02HLB.

PHYS 02LC General Physics Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in PHYS 002C; PHYS 002B with a grade of C- or better or PHYS 02HB with a grade of C- or better; PHYS 02LB with a grade of C- or better or PHYS 02HLB with a grade of C- or better. Illustrates the experimental foundations of physics presented in PHYS 002C. Topics include electromagnetism, quantum physics, and Coulomb's Law. Covers electric field, electrical potential, resistors, capacitors, simple circuits, magnetic forces, Faraday's Law. Also addresses basic quantum physics of light, atoms, and radioactivity. Credit is awarded for one of the following PHYS 02LC or PHYS 02HLC.

CHEM 001A General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LA; MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or CHEM 001W with a grade of S or better or CHEM 001 with a grade of S or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 009C with a grade of C- or better; or a score of 3, 4, or 5 on the College Board Advanced Placement Chemistry Examination or Advanced Placement Calculus Examination or a passing score on the California Chemistry Diagnostic Test or a score on the Mathematics Advisory Exam sufficient for placement in MATH 007A or MATH 009A. An introduction to the basic principles of chemistry. Instructional methods are either in-person lectures or virtual online lectures. Credit is awarded for one of the following CHEM 001A, CHEM 002A, or CHEM 01HA.

CHEM 001B General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LB; CHEM 001A with a grade of C- or better, CHEM 01LA with a grade of C- or better or CHEM 01HA with a grade of C- or better, CHEM 1HLA with a grade of C- or better or CHEM 002A with a grade of C- or better, CHEM 02LA with a grade of C- or better. An introduction to the basic principles of chemistry. Provides lectures either in person or in a virtual online environment, depending on section offerings. Credit is awarded for one of the following CHEM 001B, CHEM 002B, or CHEM 01HB.

CHEM 001C General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 01LC; CHEM 001B with a grade of C- or better or CHEM 01HB with a grade of C- or better; CHEM 01LB with a grade of C- or better or CHEM 1HLB with a grade of C- or better or CHEM 002B with a grade of C- or better, CHEM 02LB with a grade of C- or better. An introduction to the basic principles of chemistry. Provides lectures either in person or in a virtual online environment, depending on section offerings. Credit is awarded for one of the following CHEM 001C, CHEM 002C, or CHEM 01HC.

CHEM 01HA Honors General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 1HLA; MATH 007A, may be taken concurrently or MATH 009A, may be taken concurrently or MATH 09HA, may be taken concurrently or MATH 007B or MATH 009B or MATH 09HB; or equivalent or a score of 4 or 5 on the College Board Advance Placement Chemistry Examination; a score of 600 or higher on the Mathematics portion of the SAT Reasoning Test or a score of 25 or higher on the ACT Mathematics Test; high school chemistry; or consent of instructor. Honors course corresponding to CHEM 001A. Covers the principles of chemistry in greater depth than in CHEM 001A. A limited enrollment course. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 01HA, CHEM 001A, or CHEM 002A.

CHEM 01HB Honors General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 1HLB; CHEM 001A with a grade of B or better or CHEM 01HA with a grade of B or better or CHEM 01LA with a grade of B or better or CHEM 1HLA with a grade of B or better or CHEM 002A with a grade of B or better or CHEM 02LA with a grade of B or better; admission to University Honors. Honors course corresponding to CHEM 001B. Covers the principles of chemistry in more depth than in CHEM 001B. A limited enrollment course. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 01HB, CHEM 001B, or CHEM 002B.

CHEM 01HC Honors General Chemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): concurrent enrollment in CHEM 1HLC; CHEM 001B with a grade of B or better or CHEM 01HB with a grade of B or better or CHEM 002B with a grade of C- or better; CHEM 01LB or CHEM 1HLB or CHEM 02LB; admission to University Honors. Honors course corresponding to CHEM 001C. Covers the principles of chemistry in more depth than in CHEM 001C. A limited enrollment course. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 01HC, CHEM 001C, or CHEM 002C.

CHEM 1HLA Honors General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s):

concurrent enrollment in CHEM 01HA; MATH 009A, may be taken concurrently or MATH 009B, may be taken concurrently or MATH 09HA, may be taken concurrently or MATH 007A, may be taken concurrently or MATH 007B, may be taken concurrently or MATH 009C, may be taken concurrently or CHEM 001 or CHEM 001W; admission to University Honors. Honors course corresponding to CHEM 01LA. An introduction to laboratory principles and techniques related to lecture topics in CHEM 01HA. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 1HLA, CHEM 01LA, or CHEM 02LA.

CHEM 1HLB Honors General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 01HB; CHEM 001A with a grade of B or better, CHEM 01LA with a grade of B or better or CHEM 01HA with a grade of B or better, CHEM 1HLA with a grade of B or better or CHEM 002A with a grade of B or better, CHEM 02LA with a grade of B or better; admission to University Honors. Honors course corresponding to CHEM 01LB. An introduction to laboratory principles and techniques related to lecture topics in CHEM 01HB. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 1HLB, CHEM 01LB, or CHEM 02LB.

CHEM 1HLC Honors General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 01HC; CHEM 001B with a grade of B or better or CHEM 01HB with a grade of B or better or CHEM 002B; CHEM 01LB or CHEM 1HLB or CHEM 02LB; admission to University Honors. Honors course corresponding to CHEM 01LC. An introduction to laboratory principles and techniques related to lecture topics in CHEM 01HC. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 1HLC, CHEM 01LC, or CHEM 02LC.

CHEM 01LA General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001A; MATH 005A with a grade of C- or better or MATH 006A with a grade of C- or better or CHEM 001W with a grade of S or better or CHEM 001 with a grade of S or better or MATH 007A with a grade of C- or better or MATH 007B with a grade of C- or better or MATH 009A with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 006B with a grade of C- or better or MATH 009C with a grade of C- or better; or a score of 3, 4, or 5 on the College Board Advanced Placement Chemistry Examination or Advanced Placement Calculus Examination or a passing score on the California Chemistry Diagnostic Test or a score on the Mathematics Advisory Exam sufficient for placement in MATH 007A or MATH 009A. An introduction to laboratory principles and techniques related to lecture topics in CHEM 001A. Credit is awarded for one of the following CHEM 01LA, CHEM 02LA, or CHEM 1HLA.| **221**

CHEM 01LB General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001B; CHEM 001A with a grade of C- or better or CHEM 01HA with a grade of C- or better or CHEM 01LA with a grade of C- or better or CHEM 1HLA with a grade of C- or better or CHEM 002A with a grade of C- or better or CHEM 02LA with a grade of C- or better. An introduction to laboratory principles and techniques related to lecture topics in CHEM 001B. Credit is awarded for one of the following CHEM 01LB, CHEM 02LB, or CHEM 1HLB.

CHEM 01LC General Chemistry Laboratory 1 Laboratory, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 001C; CHEM 001B with a grade of C- or better or CHEM 01HB with a grade of C- or better or CHEM 002B; CHEM 01LB or CHEM 1HLB or CHEM 02LB. An introduction to laboratory principles and techniques related to lecture topics in CHEM 001C. Credit is awarded for one of the following CHEM 01LC, CHEM 02LC, or CHEM 1HLC.

CHEM 008A Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LA; CHEM 001C with a grade of C- or better, CHEM 01LC with a grade of C- or better or CHEM 01HC with a grade of C- or better, CHEM 1HLC with a grade of C- or better or CHEM 002C with a grade of C- or better, CHEM 02LC with a grade of C- or better. Covers modern organic chemistry including hydrocarbon structure and nomenclature, stereochemistry, and reaction mechanisms. Provides lectures either in person or in a virtual online environment, depending on section offerings. Credit is awarded for one of the following CHEM 008A or CHEM 08HA.

CHEM 008B Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LB; CHEM 008A with a grade of C- or better, CHEM 08LA with a grade of C- or better or CHEM 08HA with a grade of C- or better, CHEM 08HLA with a grade of C- or better. Covers modern organic chemistry including structural determination via spectroscopic analysis, reactivity, reaction mechanisms, and multistep organic synthesis. Credit is awarded for one of the following CHEM 008B or CHEM 08HB.**222** |

CHEM 008C Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08LC; CHEM 008B with a grade of C- or better, CHEM 08LB with a grade of C- or better or CHEM 08HB with a grade of C- or better, CHEM 08HLB with a grade of C- or better. Covers modern organic chemistry and chemical biology including reactivity and synthesis. Also includes reaction mechanisms and the chemistry of carbohydrates, lipids, nucleic acids, amino acids, and proteins. Credit is awarded for one of the following CHEM 008C or CHEM 08HC.

CHEM 08HA Honors Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08HLA; CHEM 001C with a grade of B or better, CHEM 01LC with a grade of B or better or CHEM 01HC with a grade of B or better, CHEM 1HLC with a grade of B or better or CHEM 002C with a grade of B or better, CHEM 02LC with a grade of B or better; admission to University Honors; or consent of instructor. Honors course corresponding to CHEM 008A. Covers the principles of organic chemistry in greater depth than in CHEM 008A. Covers modern organic chemistry including hydrocarbon structure and nomenclature, stereochemistry, and reaction mechanisms. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 08HA or CHEM 008A.

CHEM 08HB Honors Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08HLB; CHEM 008A with a grade of B or better, CHEM 08LA with a grade of B or better or CHEM 08HA with a grade of B or better, CHEM 08HLA with a grade of B or better; admission to University Honors; or consent of instructor. Honors course corresponding to CHEM 008B. Honors course that covers the principles of organic chemistry in greater depth than in CHEM 008B. Covers modern organic chemistry including structural determination via

spectroscopic analysis, reactivity, reaction mechanisms and multistep organic synthesis. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 08HB or CHEM 008B.

CHEM 08HC Honors Organic Chemistry 3 Lecture, 3 hours. Prerequisite(s): concurrent enrollment in CHEM 08HLC; CHEM 008B with a grade of B or better, CHEM 08LB with a grade of B or better or CHEM 08HB with a grade of B or better, CHEM 08HLB with a grade of B or better; or consent of instructor. Honors course corresponding to CHEM 008C. Covers modern organic chemistry and chemical biology including reactivity, synthesis, and reaction mechanisms. Also includes the chemistry of carbohydrates, lipids, nucleic acids, amino acids, and proteins. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 08HC or CHEM 008C.

CHEM 08HLA Honors Organic Chemistry Lab 1 Laboratory, 4 hours. Prerequisite(s): CHEM 001C with a grade of C- or better, CHEM 01LC with a grade of C- or better or CHEM 01HC with a grade of C- or better, CHEM 1HLC with a grade of C- or better or CHEM 002C with a grade of C- or better, CHEM 02LC with a grade of C- or better; admission to University Honors. Honors course corresponding to CHEM 08LA. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Satisfactory(S) or No Credit(N/C) is not available. Credit is awarded for one of the following CHEM 08HLA or CHEM 08LA.

CHEM 08HLB Honors Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): CHEM 008A and CHEM 08LA or CHEM 08HA and CHEM 08HLA with a grade of “B” or better or consent of instructor; concurrent enrollment in CHEM 08HB or a grade of “B” or better in CHEM 08HB. Honors course corresponding to CHEM 08LB in depth. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Satisfactory (S) or No Credit (NC) grading is not available. Credit is awarded for only one of CHEM 08LB or CHEM 08HLB.

CHEM 08HLC Honors Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): CHEM 008B and CHEM 08LB or CHEM 08HB and CHEM 08HLB with a grade of “B” or better or consent of instructor; concurrent enrollment in CHEM 08HC or a grade of “B” or better in CHEM 08HC. Honors course corresponding to CHEM 08LC in depth. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Satisfactory (S) or No Credit (NC) grading is not available. Credit is awarded for only one of CHEM 08LC or CHEM 08HLC.

CHEM 08LA Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): concurrent enrollment in CHEM 008A; CHEM 001C with a grade of C- or better, CHEM 01LC with a grade of C- or better or CHEM 01HC with a grade of C- or better, CHEM 1HLC with a grade of C- or better or CHEM 002C with a grade of C- or better, CHEM 02LC with a grade of C- or better. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Credit is awarded for one of the following CHEM 08LA or CHEM 08HLA.

CHEM 08LB Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): CHEM

008A and CHEM 08LA or CHEM 08HA and CHEM 08HLA with grades of “C-” or better; concurrent enrollment in CHEM 008B or a grade of “C-” or better in CHEM 008B. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Credit is awarded for only one of CHEM 08LB or CHEM 08HLB.

CHEM 08LC Organic Chemistry Laboratory 1 Laboratory, 4 hours. Prerequisite(s): CHEM 008B and CHEM 08LB or CHEM 08HB and CHEM 08HLB with grades of “C-” or better; concurrent enrollment in CHEM 008C or a grade of “C-” or better in CHEM 008C. An introduction to laboratory techniques of purification, isolation, synthesis, reactions, and spectroscopic analysis. Credit is awarded for only one of CHEM 08LC or CHEM 08HLC.

BIOL 005B Introduction to Organismal Biology 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A with a grade of C- or better; BIOL 05LA with a grade of C- or better or BIOL 020 with a grade of C- or better; CHEM 001A, CHEM 01LA or CHEM 01HA, CHEM 1HLA or CHEM 002A, CHEM 02LA; CHEM 001B, may be taken concurrently, CHEM 01LB, may be taken concurrently or CHEM 01HB, may be taken concurrently, CHEM 1HLB, may be taken concurrently or CHEM 002B, may be taken concurrently, CHEM 02LB, may be taken concurrently. An intensive course designed to prepare for upper-division courses in organismal biology. Covers developmental biology, physiology, and regulation at the level of the organism. Required for Biology majors; recommended for science majors desiring an introduction to biology.

BIOL 005C Introductory Evolution and Ecology 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005A with a grade of C- or better; BIOL 05LA with a grade of C- or better or BIOL 020 with a grade of C- or better; BIOL 005B with a grade of C- or better; MATH 009A with a grade of C- or better or MATH 09HA with a grade of C- or better or MATH 007A with a grade of C- or better; CHEM 001C, may be taken concurrently, CHEM 01LC, may be taken concurrently or CHEM 01HC, may be taken concurrently, CHEM 1HLC, may be taken concurrently or CHEM 002C, may be taken concurrently, CHEM 02LC, may be taken concurrently. An intensive introduction to the subjects of evolution and ecology. Covers population dynamics, community ecology, population genetics, and evolutionary theory. Recommended for science majors desiring an introduction to biology. Students who take equivalent first-year biology at another institution may enter directly into BIOL 005C without critical handicap.

BIOL 05LA Introduction to Cell and Molecular Biology Laboratory 1 Laboratory, 3 hours. Prerequisite(s): BIOL 005A (may be taken concurrently); consent of instructor is required for students repeating the course. An introduction to laboratory exercises on fundamental principles of and techniques in cell and molecular biology. Illustrates the experimental foundations of the topics covered in BIOL 005A. Credit is awarded for only one of BIOL 020 or BIOL 05LA.

BIOL 102 Introductory Genetics 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 020 or BIOL 05LA, and BIOL 005B with grades of “C-” or better. An introductory course that includes classical Mendelian genetics, linkage and recombination, sex-linked traits, cytogenetics, developmental genetics, and molecular genetics. Also includes some probability

theory and statistics.

BIOL 107A Molecular Biology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 008C and CHEM 08LC, or CHEM 08HC and CHEM 8HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BHC 110HA. The study of the structure and function of the genetic material, including DNA structure, DNA replication and recombination, regulation of gene expression, and protein synthesis. Examines both prokaryotic and eukaryotic systems including contemporary recombinant DNA technology and applications of molecular cloning procedures. Credit is not awarded for BIOL 107A if it has already been awarded for BCH 110C.

BIOL 110 Biology of Human Problems 4 Seminar, 4 hours. Prerequisite(s): BIOL 005A, BIOL 005B, BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 008C and CHEM 08LC, or CHEM 08HC and CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002C or PHYS 02HC, PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA; one course in statistics. Devoted to selected human problems that have a large biological component and relate to medicine, ethics, and human existence. Topics covered vary and include issues of major bioethical importance such as euthanasia, national health care, effects of industrial pollution on individuals and communities, population problems, abortion, and genetic engineering.

BIOL 121 Introductory Microbiology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A; BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 001C or CHEM 01HC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002A, may be taken concurrently or PHYS 02HA, may be taken concurrently; PHYS 02LA, may be taken concurrently or PHYS 02HLA, may be taken concurrently; BCH 100, may be taken concurrently or BCH 110A, may be taken concurrently or BCH 110HA, may be taken concurrently; STAT 010; or consent of instructor. An intensive introduction to the fundamental physiology and molecular biology of bacteria and viruses. Covers bacterial and viral molecular genetics, an introduction to microbial pathogenesis, and applications of microbiology in modern societies. Cross-listed with MCBL 121. Credit is awarded for one of the following MCBL 121, BIOL 121, or MCBL 131.

BIOL 121L Microbiology Laboratory 3 Lecture, 1 hour; laboratory, 6 hours. Prerequisite(s): BIOL 121 with a grade of C- or better or MCBL 121 with a grade of C- or better. Laboratory exercises in diagnostic bacteriology, basic virology, and epidemiology. Includes fundamental quantitative and diagnostic microbiological procedures, basic mechanisms of microbial genetic exchange, and a project examining bacterial epidemiology. Cross-listed with MCBL 121L. Credit is awarded for one of the following MCBL 121L, BIOL 121L, or MCBL 131L.

BIOL 128 Immunology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005C; PHYS 002C or PHYS 02HC; PHYS 02LC or PHYS 02HLC; BCH 100 or BCH 110A or BCH 110HA. A study of humoral and cellular immunology. Topics include lymphoid systems, cells, antigens, antibodies, antibody formation, cellular immunity, and tumor and transplantation immunology. Discusses in detail diseases and altered immune states associated with each

topic. Cross-listed with CBNS 128.

BIOL 161A Functional Anatomy of the Vertebrates 5 Lecture, 3 hours; laboratory, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of C- or better; BIOL 005B with a grade of C- or better; BIOL 005C with a grade of C- or better; CHEM 001C with a grade of C- or better or CHEM 01HC with a grade of C- or better; CHEM 008A with a grade of C- or better or CHEM 08HA with a grade of C- or better, CHEM 08LA with a grade of C- or better or CHEM 08HLA with a grade of C- or better; MATH 007B with a grade of C- or better or MATH 009B with a grade of C- or better or MATH 09HB with a grade of C- or better; PHYS 002A with a grade of C- or better or PHYS 02HA with a grade of C- or better. Functional anatomy of vertebrates including humans. Examines organ systems from developmental and evolutionary perspectives. Topics include phylogeny, the skeleton, and muscles. A combination of BIOL 161A, BIOL 161B, BIOL 171A, BIOL 171B, and BIOL 171L provide a one-year sequence in anatomy and physiology.

BIOL 161B Functional Anatomy of the Vertebrates 5 Lecture, 3 hours; laboratory, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 161A with a grade of C- or better; CHEM 008B with a grade of C- or better or CHEM 08HB with a grade of C- or better, CHEM 08LB with a grade of C- or better or CHEM 08HLB with a grade of C- or better; PHYS 002B with a grade of C- or better or PHYS 02HB with a grade of C- or better. Functional anatomy of vertebrates including humans. Examines organ systems from developmental and evolutionary perspectives. Topics include nervous system, integument, and circulatory, sensory, respiratory, digestive, and urogenital systems. A combination of BIOL 161A, BIOL 161B, BIOL 171A, BIOL171B, and BIOL 171L provides a one-year sequence in anatomy and physiology.

BIOL 171A Human Anatomy 4 Lecture, 3 hours; laboratory, 3 hours. Prerequisite(s): BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 01LC or CHEM 1HLC; CHEM 008B or CHEM 08HB; CHEM 08LB or CHEM 08HLB; MATH 007B or MATH 009B or MATH 09HB; PHYS 002B or PHYS 02HB; PHYS 02LB or PHYS 02HLB. Introduction to the structure of the human body using the an organ-systems approach. Emphasizes an overview of the major elements of human anatomy, a brief introduction to function (i.e., physiology), and the relationships among organs and organ systems. Labs provide hands-on identification of human anatomy.

BIOL 171B Human Physiology 1 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A; BIOL 05LA or BIOL 020; BIOL 005B; BIOL 005C; CHEM 001C or CHEM 01HC; CHEM 01LC or CHEM 01HLC; CHEM 008C or CHEM 08HC; CHEM 08LC or CHEM 08HLC; MATH 007B or MATH 009B or MATH 09HB; PHYS 002B or PHYS 02HB; PHYS 02LB or PHYS 02HLB; BCH 100 or BCH 110A or BCH 110HA. Provides first-principles analysis of cell, tissue, and organ structure and function. Emphasizes an integrative, problem-solving approach using applications such as disease and exercise. Topics include the musculoskeletal, nervous, endocrine, and reproductive systems.

BCH 100 Introductory Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of C- or better; CHEM 08HB with a grade of C- or better or CHEM 008B with a grade of C- or better; CHEM 08LB with a grade of C- or better or CHEM 08HLB with a

grade of C- or better. Introduction to the biochemistry of living organisms based on a study of the structure, function, and metabolism of small molecules and macromolecules of biological significance. Examines selected animals, plants, and microorganisms to develop a general understanding of structure-function relationships, enzyme action, regulation, bioenergetics, and intermediary metabolism. Credit is awarded for one of the following BCH 100 or BCH 100H. Credit is not awarded for BCH 100 if a grade of “C-” or higher has been awarded previously in BCH 110A or BCH 110HA or BCH 110B or BCH 110HB or BCH 110C or BCH 110HC.

BCH 110A General Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BIOL 005A with a grade of “C-” or better; CHEM 008C and CHEM 08LC or CHEM 08HC and CHEM 08HLC with grades of “C-” or better. Considers the structure and function of biological molecules including proteins, carbohydrates, lipids, and nucleic acids. Credit is awarded for only one of BCH 110A or BCH 110HA.

BCH 110B General Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA with a grade of “C-” or better or consent of instructor. Consideration of metabolic pathways including mechanisms and regulation of catabolism, anabolism, and bioenergetics in living organisms. Credit is awarded for only one of BCH 110B or BCH 110HB.

BCH 110C General Biochemistry 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): BCH 110A or BCH 110HA with a grade of “C-” or better, BIOL 102 or consent of instructor. BCH 110B or BCH 110HB is highly recommended. Considers regulation of gene expression, protein synthesis, chromatin structure, genome replication, recombination, and repair. Examines both prokaryotic and eukaryotic systems, including recombinant DNA technology, protein engineering, and applications to molecular medicine. Credit is not awarded for BCH 110C if it has already been awarded for BCH 110HC or BIOL 107A.

PBPL 160 Immigrant Health and Wellbeing 4 Lecture, 3 hours; individual study, 2 hours; term paper, 1 hour. Prerequisite(s): restricted to class level standing of junior, or senior. Introduction to community-engaged methods in health disparities research. Examines health disparities and social determinants of health and conducts in-depth examination of community engaged research methods. Provides theoretical principles, methods, and skills needed to plan and implement community-engaged research.

PBPL 162 Health in All Policies 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): PBPL 001 with a grade of C- or better or SOC 001 with a grade of C- or better or SOC 001H with a grade of B or better; restricted to class level standing of junior, or senior. Explores social influences on health and the role that public policies play in shaping the social determinants of health. Examines the link between social circumstances (socioeconomics, race, ethnicity, environment) and health outcomes. Identifies connections and considers whether and to what extent public policy mitigates harmful influences or stimulates positive outcomes.

SOC 127 Sociological Determinants of Health 4 Lecture, 3 hours; discussion, 1 hour; extra reading, 5 hours; research, 3 hours. Prerequisite(s): SOC 001 with a grade of C-or better or SOC 001H with a grade of C- or better; or consent of instructor. Introduces the role that social

factors play in shaping the occurrence and distribution of disease and death in populations with an emphasis on socioeconomic status, racism, social relationships and social stress. A particular emphasis is placed on sociological origins of health inequalities. Cross-listed with PBPL 127.

SOC 167 Medical Sociology 4 Lecture, 3 hours; discussion, 1 hour. Prerequisite(s): restricted to class level standing of junior, or senior; or consent of instructor. Introduces key concepts and theories in medical sociology and their application to a variety of health issues. Exemplar topics include social construction of health and illness, medicalization, stigma and labeling, patient-provider interaction, sociology of medical professionals, social determinants of health, and political economy of health. Cross-listed with PBPL 167.

Bourns College of Engineering
Department of Computer Science & Engineering
900 University Avenue
Riverside, CA 92521

February 25, 2025

To Whom It May Concern,

I enthusiastically support the proposed Computer Science Applications undergraduate major. Current and future students view computers and their constituent technologies as a core parts of society and their lives, intertwined with their other interests. Many students wish to study this intersection. Many employers which to employ students who have a foundational understanding of not only Computer Science but also an application area. Our external advisory board of industry leaders discussed this proposal in June 2024 and enthusiastically supported its curriculum and goals.

This major broadens the existing Computer Science with Business Applications major to invite more undergraduates to explore the combination of Computer Science and other discipline. It will start with concentrations in Business, Psychology, and Health Sciences. We have active and excited partners in each of these areas. We believe it can grow in the future to other areas. This major complements our existing Computer Science and Computer Engineering majors by providing a more applications-oriented, but still technical, study of Computer Science.

The faculty in the Computer Science and Engineering Department (where the program will be housed) voted unanimously (22-0-0) in favor of adding this major. We are committed to providing the necessary courses.

Sincerely,

Christian Shelton
Professor & Department Chair
Computer Science & Engineering

UC RIVERSIDE

Department of Computer Science and Engineering
900 University Avenue
351 Winston Chung Hall
Riverside, CA 92521

DATE: February 7, 2025

TO: Academic Senate
Committee on Educational Policy

FROM: Christian Shelton
Chair, Department of Computer Science

RE: Department approval for new Computer Science Applications major

The Department of Computer Science and Engineering faculty met on Wednesday January 22, 2025 to discuss and vote on this new major proposal. The faculty voted unanimously in favor (22 present, 22 yes) of this new major proposal and to move it forward for approval.

Thank you for your time and consideration.

UC RIVERSIDE
Marlan and Rosemary Bourns
College of Engineering

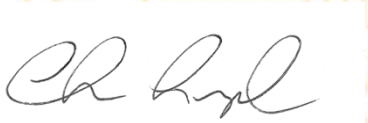
Office of the Dean
900 University Avenue
446 Winston Chung Hall
Riverside, CA 92521

To Whom It May Concern:

I endorse the proposed Computer Science Applications (CSA) undergraduate major. It is well positioned to attract a broad set of students interested in computers and how computational technology is connected to other disciplines. The program creates ties between BCOE and other colleges.

BCOE is committed to supporting this new major by offering the courses, advising, and other resources necessary for its students' success.

Sincerely,



Christopher Lynch
Dean, Bourns College of Engineering
University of California Riverside

TO: Dean Daryle Williams, CHASS

FROM: Tuppett M. Yates, Psychology Department Chair

DATE: February 5, 2025

RE: Support for a Psychology Track within the new Computer Science Applications Major

Dear Dean Williams:

As Chair of the Department of Psychology, I am writing to express our strong support for the proposed undergraduate academic program, the B.S. in Computer Science Applications, to be administered by the Computer Science Department. Our department has voted to unanimously approve the inclusion of Psychology courses to fulfill the Psychology concentration requirements (34 eligible, 29 yes, 0 no, 0 abstain, 5 not available). We believe this major will provide a valuable pedagogical bridge between Computer Science and the Social Sciences.

The Psychology concentration curriculum was carefully designed and approved by faculty in both departments. It offers students a pathway to learn foundational concepts and research methods within psychology, while providing flexibility for students to pursue depth of study in advanced psychological concepts.

Furthermore, the program's emphasis on data analysis training and the flexible senior design project options align with the research interests of many of our faculty who employ sophisticated computational and data science tools in their research programs. Thus, this program will encourage active engagement between undergraduate students and our researchers.

We acknowledge that students in the Computer Science Applications program will increase demand for our already popular Psychology courses, particularly PSYC 11 (Psychological Methods: Statistical Procedures) and PSYC 12 (Psychological Methods: Research Procedures). These are foundational courses within our program with capped enrollment due to their hands-on and intensive nature. Our faculty have agreed to hold seats in these courses for students in the proposed major to accommodate the annual enrollment of up to 30 undergraduate students in this proposed track. Please note that this commitment is contingent upon the ongoing approval of the Committee on Courses to reserve seats in these courses. Each quarter, any unused seats will be released at the same time as the seats for Psychology Majors. Thirty slots are confirmed for the first 5 years with active students in this major after which an assessment will be conducted to see if the number of reserved seats should be increased or decreased.

Looking forward, we are committed to working collaboratively with the Chair of Computer Science and the Dean of the College of Humanities, Arts, and Social Sciences to secure the necessary resources to meet the demands of this proposed major.

Thank you for considering this request.

Tuppett M. Yates, PhD

School of Business
Anderson Hall
900 University Avenue
Riverside, CA 92521

UC RIVERSIDE | School of Business
A. GARY ANDERSON GRADUATE SCHOOL OF MANAGEMENT

VIA EMAIL

February 7, 2025

Dear Colleagues of the Academic Senate,

As Department Chair of the School of Business, I support the proposed new major in Computer Science Applications (CSA) offered by the Department of Computer Science and Engineering of the Marlan and Rosemary Bourns College of Engineering. This new major will be based on the current Computer Science with Business Applications major, the content of which will remain available as a concentration within the new CSA major. This change will continue to make the combination of the computing and business disciplines attractive to a relatively small group of students interested in breadth across both areas.

In addition, I approve the continued inclusion of all BUS courses in the new major, as well as the addition of BUS 10. These courses are offered regularly throughout the academic year. Given the relatively small size of the new major, space in these courses will not be an issue.

Please let me know if you need any additional information.

Sincerely,

Margaret C. Campbell, Chair and Associate Dean

School of Business

Pre-Professional Advising Center
Division of Undergraduate Education

900 University Avenue
Rivera Library B03
Riverside, CA 92521

951.827.6233
hpac@ucr.edu | ppac.ucr.edu

14 February 2025

Re: Letter of Support for Computer Sciences Applications (CSA) Program

Dear Colleagues:

I write this letter of support for the Bachelor of Science in Computer Sciences Application (CSA) Program to be located in the Marlan and Rosemary Bourns College of Engineering at the University of California, Riverside.

The creation of this academic program will allow students who wish to explore a career in computer sciences and health professions to gain the necessary pre-requisite health sciences/life sciences coursework as required by medical schools and other health professions programs such as dentistry, optometry, pharmacy, veterinary medicine and so forth. To date, ~75% of our applicants to health professions programs come from the College of Natural and Agricultural Sciences with viable growth opportunities in all of UCR colleges/schools. For prospective students who are looking to integrate computer sciences and biological sciences and health informatics into clinical practice, this pathway will likely be a popular pathway.

In addition to the health sciences concentration that would provide a direct course flow, students would also have the support of pre-health advisors at the Pre-Professional Advising Center, an advising unit within the Division of Undergraduate Education that provides information, advising, and support for students who aspire to graduate/professional programs in the health professions and law to map out academic and curricular experiences to support a competitive application to medical school or other health professions programs.

Should you have questions regarding this letter of support *or* if I may advocate further on behalf of this new academic program, please don't hesitate to contact me at Charles.Scruggs@ucr.edu or at 951-827-5416.

Sincerely,

Charles P. Scruggs, M.A.
Director, UCR Pre-Professional Advising Center

President, Western Association of Advisors for the Health Professions
Board of Directors, National Association of Advisors for the Health Professions

Round 1 Documents

UC RIVERSIDE | Evolution, Ecology, & Organismal Biology

Joel L. Sachs, PhD Professor & Chair,
Department of Evolution Ecology & Organismal Biology

Professor of Biology & Plant Evolutionary Ecologist
Department of Botany and Plant Science (Cooperating)
Department of Microbiology & Plant Pathology (Cooperating)
Institute of Integrative Genome Biology

University of California
#5406 Boyce Hall
Riverside, CA 92521

Office (951) 827-6357
Fax (951) 827 4286
E-mail: joels@ucr.edu
www.sachslab.com

Dear Neftali,

24, February, 2025

I am writing to express my support for the establishment of a new Computer Science Applications Major (CSA), in particular the CSA major with the concentration in Health Science.

The EEOB faculty discussed the utility of this program and agree with your proposal that this could fulfil a key training need. We agree that the CSA major would be particularly useful for students with career aspirations at the nexus of the computer and health sciences.

We have reviewed the required courses for the CSA major with the concentration in Health Science, including BIOL 005A, BIOL 005LA, BIOL 005B, and BIOL 005C. These courses provide core knowledge in basic biology. Completion of these classes would provide the same training that a typical sophomore would receive after completion of their first year as a Biology major at UCR.

We noted that you also provided for Biology 'technical' electives, including BIOL 102, BIOL 107A, BIOL 110, BIOL 121/L, BIOL 128, BIOL 161 A, BIOL 161B, BIOL 171A, BIOL 171B. We agree that any of these classes would provide important training in addition to the above required courses. In total this could provide preparation for the health sciences in addition to the training in computer sciences.

Joel L. Sachs, Professor & Chair,
Department of Evolution Ecology & Organismal Biology
University of California Riverside

UC RIVERSIDE | College of Humanities, Arts, and Social Sciences

Office of the Dean, 3413 HMNSS Building

MEMORANDUM

To: Christopher Lynch, Dean, Bourns College of Engineering

From: Daryle Williams, Dean, College of Humanities, Arts, and Social Sciences

DocuSigned by: Daryle Williams DF5B1DF553974F3...

Date: February 26, 2025

RE: **Support for the Psychology Concentration in the BS degree program in Computer Science Applications**

As Dean of CHASS, I support the proposed B.S. degree program in Computer Science Applications (CSA) to be administered by the BCOE Computer Science and Engineering Department. This program has three concentrations, two of which are Psychology and Business that rely on the offering of a substantial number of courses offered by the Department of Psychology and a couple courses offered by the Department of Economics. I applaud the initiative of creating interdisciplinary and intercollege majors that will improve the learning experience of our students and respond to a growing demand for professionals with computer science knowledge across many disciplines.

The Psychology department has enthusiastically approved this concentration and I support their endorsement. I concur with their positive assessment on the design of the Psychology concentration curriculum and it is my hope that it will create synergies between undergraduate engineering students and Psychology faculty whose research interests rely on computational and data science tools.

Four courses (PSYC 1, PSYC 2, PSYC 11, and PSYC 12) in the Psychology concentration are considered impacted courses. The proposed CSA major will increase the demand for these courses. CHASS Psychology majors will have priority in enrolling in these courses. The Psychology department is willing to reserve up to 30 seats annually in PSYC 11 and PSYC 12, which have capped enrollments, for the first five years. We should closely monitor enrollments to understand the impact of the new demand and revise the allotment of seats if needed.

I look forward to working with the BCOE Computer Science and Engineering department to assure the success of the proposed major.

Certificate Of Completion

Envelope Id: FDE3259D-50CB-4B1A-B63C-3ADEE6945F24
Status: Completed
Subject: Complete with Docusign: CSAMajor-PSYC-Concentration-2025-02-26.docx
Source Envelope:
Document Pages: 1
Signatures: 1
Envelope Originator:
Certificate Pages: 1
Initials: 0
Summer Espinoza
AutoNav: Enabled
100 Phoenix Dr.Suite 111
EnvelopeId Stamping: Enabled
Lansing, MI 48108
Time Zone: (UTC-08:00) Pacific Time (US & Canada)
summer.espinoza@ucr.edu
IP Address: 138.23.220.221

Record Tracking

Status: Original
2/25/2025 4:51:11 PM
Holder: Summer Espinoza
summer.espinoza@ucr.edu
Location: DocuSign

Signer Events	Signature	Timestamp
Daryle Williams daryle.williams@ucr.edu Dean, CHASS University of California, Riverside Security Level: Email, Account Authentication (None)	DocuSigned by: Daryle Williams DF5B1DF553974F3... Signature Adoption: Pre-selected Style Using IP Address: 169.235.64.141	Sent: 2/25/2025 4:52:17 PM Viewed: 2/25/2025 4:53:18 PM Signed: 2/25/2025 4:53:22 PM

Electronic Record and Signature Disclosure:
Not Offered via Docusign

In Person Signer Events	Signature	Timestamp

Editor Delivery Events	Status	Timestamp

Agent Delivery Events	Status	Timestamp

Intermediary Delivery Events	Status	Timestamp

Certified Delivery Events	Status	Timestamp

Carbon Copy Events	Status	Timestamp

Witness Events	Signature	Timestamp

Notary Events	Signature	Timestamp

Envelope Summary Events	Status	Timestamps
Envelope Sent	Hashed/Encrypted	2/25/2025 4:52:17 PM
Certified Delivered	Security Checked	2/25/2025 4:53:18 PM
Signing Complete	Security Checked	2/25/2025 4:53:22 PM
Completed	Security Checked	2/25/2025 4:53:22 PM

Payment Events	Status	Timestamps

Round 1 Documents

Mathchair <mathchair@ucr.edu> Fri, Feb 14, 2025 at 12:38 PM
To: Neftali Watkinson Medina <neftaliw@ucr.edu>
Cc: Christian Shelton <cshelton@cs.ucr.edu>

Hi Neftali,

After reviewing the proposal, we find nothing to object to. You can say that. But is the Math Department somehow in the chain of approval for the proposal? That would seem to imply something more. I have never been through this kind of thing before.

Regards,
- Jim
[Quoted text hidden]

Neftali Watkinson Medina <neftaliw@ucr.edu> Fri, Feb 14, 2025 at 12:49 PM
To: Mathchair <mathchair@ucr.edu>
Cc: Christian Shelton <cshelton@cs.ucr.edu>

Hi James,

Sorry for not being clear in my prior email. This statement you are providing is enough, it is to satisfy the following requirement by the Committee on Educational Policy:

9. Potential impact of the new program on existing programs. If the proposed program includes required courses from a department other than the administering department, the proposal must include a statement from the department indicating that it has been consulted and that it will provide access to the required courses.

Since your prior email had some suggested changes, I wanted to make sure that you agreed to the fixes I highlighted (primarily removing Math 8). Other than that, your email suffices as the required statement.

Neftali W.
[Quoted text hidden]

Mathchair <mathchair@ucr.edu> Fri, Feb 14, 2025 at 12:55 PM
To: Neftali Watkinson Medina <neftaliw@ucr.edu>
Cc: Christian Shelton <cshelton@cs.ucr.edu>

Hi Neftali,

That is good then. The only other comment I would make is that there is a Math 135C now as well, if you wanted to include it.

Regards,
- Jim
[Quoted text hidden]

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Leonard Mueller
Professor of Chemistry and Chair
Department of Chemistry
University of California, Riverside

(951) 827=3565
leonard.mueller@ucr.edu

20 February 2025

BCOE Executive Committee
UC Riverside

Dear Executive Committee,

As the Chair of the Department of Chemistry, I have reviewed the proposal for an undergraduate major in Computer Science Applications and approve of the addition of the following courses as a requirement for the Health Science concentration:

CHEM 001A and 001LA, CHEM 001B and 1LB, CHEM 001C and 001LC, CHEM 008A and 008LA, CHEM 008B and 8LB, CHEM 008C and 008LC

These courses train students in general and organic chemistry. They serve as the baseline for several programs that require a broad understanding of modern Chemistry. They also serve to satisfy the pre-health requirements for a year of general chemistry with lab, and a year of organic chemistry with lab. It makes sense that a concentration that focuses on Health Science should include these. Both series are taught throughout the year and can accommodate students from the Computer Science applications program.

Sincerely,

Leonard Mueller
Professor of Chemistry and Chair

To: Christian Shelton, Chair and Professor, Computer Science & Engineering Dept.
Neftali D. Watkinson, Assistant Professor of Teaching, Computer Science & Engineering Dept.

From: Shan-Wen Tsai, Chair and Professor, Department of Physics & Astronomy

Date: 02/21/2025

Re: **Letter of Support**

Thank you for sharing with me your proposal for the establishment of a new undergraduate academic program in Computer Science Applications, with Business, Psychology, and Health Science concentrations.

I am happy to provide this letter of support for this new program regarding the inclusion of the following courses in the curriculum: **PHYS 2A and 2LA, PHYS 2B and 2LB, PHYS 2C and 2LC**, to be required for the Health Science concentration as a path towards satisfying the Physics requirement for medical school. The PHYS 2A, B, C and corresponding laboratory portions, PHYS 2LA, B, C are a calculus-based General Physics sequence for Life and Ag Sciences majors, pre-med students, and students who plan to pursue a career in health sciences. The syllabus covers General Physics with life and health sciences applications and integrated labs.

Sincerely,

Shan-wen Tsai

_____

Shan-Wen Tsai, Chair and Professor
Department of Physics and Astronomy

Round 1 Documents

Neftali Watkinson Medina <neftaliw@ucr.edu>

Fwd: Request for letter of support from the Department of Biochemistry

Xuan Liu <xuan@ucr.edu> Fri, Feb 14, 2025 at 10:34 AM
To: Christian Shelton <cshelton@cs.ucr.edu>, Neftali Watkinson Medina <neftaliw@ucr.edu>

Hello.

Sorry for not getting back to you sooner. I was traveling.

We have no issues with non-BCH students taking BCH 100. For BCH 110A, I consulted with our Education Policy Committee as well as BCH 110A instructors. We are all supportive.

Thanks,

Xuan

Xuan Liu
Professor and Chair
Department of Biochemistry
University of California
Riverside, CA 92521
951-827-4350

UC RIVERSIDE UNIVERSITY OF CALIFORNIA

COLLEGE OF NATURAL AND AGRICULTURAL SCIENCES
DEPARTMENT OF STATISTICS
900 UNIVERSITY AVENUE
RIVERSIDE, CALIFORNIA 92521

Feb 5, 2025

To: Christian Shelton
Professor and Chair
Computer Science & Engineering Department
Bourns College of Engineering
University of California, Riverside

Dear Prof. Shelton,

I am writing to endorse the proposed new Computer Science Applications (CSA) major, which will replace the existing Computer Science with Business Applications (CSBA) major. The proposed new major includes three distinct concentrations: Business, Psychology, and Health Science. Thus, it offers enhanced flexibility and adaptability for UCR students. The new major will equip students with a strong foundation in computer science principles alongside specialized knowledge in high-demand fields. I understand the proposed new major includes the following statistics courses in the curriculum: STAT 008, STAT010, and STAT 155, and the Department of Statistics pledges to provide seats to these courses for all CSA majors.

Sincerely,

Yehua Li

Yehua Li
Professor & Chair of Statistics,
University of California, Riverside
yehuali@ucr.edu
https://profiles.ucr.edu/app/home/profile/yehuali

Round 1 Documents

R'Mail powered by Google

Neftali Watkinson Medina <neftaliw@ucr.edu>

Request for letter of support from the School of Public Policy

Bruce Babcock <babcockb@ucr.edu> Wed, Feb 5, 2025 at 10:07 AM
To: Neftali Watkinson Medina <neftaliw@ucr.edu>

Neftali:

You requested a letter of support confirming that students in the new major Computer Science Applications will have access to PBPL 160 (Immigrant Health and Well Being) and PBPL 162 (Health in All Policies). SPP does not restrict enrollment in these two courses other than placing an overall cap on class size so students in the major will have the same access as any other students.

Bruce Babcock
Professor and Associate Dean
School of Public Policy
4123 INTS
University of California, Riverside
babcockb@ucr.edu

[Quoted text hidden]

Round 1 Documents

R'Mail powered by Google

Neftali Watkinson Medina <neftaliw@ucr.edu>

Request for letter of support from the Department of Sociology

Robert Clark <roclark@ucr.edu> Tue, Jan 28, 2025 at 6:40 PM
To: Neftali Watkinson Medina <neftaliw@ucr.edu>
Cc: Christian Shelton <cshelton@cs.ucr.edu>

Hi, Neftali.

This all sounds fine to me. I can't promise when (or how frequently) we'll offer SOC 127 or 167, as we are understaffed regarding instructors. And I don't remember seeing SOC 150 being offered since I arrived here a few years ago (nor can I think of any close alternatives). But I have no objections to your including any of these courses in your curriculum. Best of luck to you!

****

Rob Clark
Professor and Acting Chair
Department of Sociology
University of California-Riverside
Riverside, CA 92521
roclark@ucr.edu

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Tony Givargis
Professor and Chair
Department of Computer Science

3201 Donald Bren Hall
Irvine, CA 92697-3435
givargis@uci.edu

February 5, 2025

To Whom It May Concern:

I am writing to express my enthusiastic support for the proposed Bachelor of Science in Computer Science Applications (CSA) at UC Riverside. As Chair of the Computer Science Department at UC Irvine and a UC Riverside alumnus, I believe this program represents a significant advancement in computer science education and complements the existing offerings within the UC system.

The increasing pervasiveness of technology in modern life has fueled an unabated demand for graduates with expertise in computer science, robotics, and software engineering. Simultaneously, we've seen a surge in demand for multidisciplinary computing programs that equip students to apply computational thinking and skills to other fields. At UC Irvine, they've responded to this need by expanding access to computing pathways through programs like the Bioinformatics minor, Health Informatics minor, the BS in Business Information Management, and the BS in Game Design and Interactive Media.

UCR has also demonstrated leadership in accessible computing education, exemplified by the Data Science program and the current Computer Science with Business Applications program. The proposed evolution of the latter into the CSA major is a timely and strategic move. This agile and flexible framework will allow UCR to adapt to industry needs, positioning students for success in the future.

The chosen concentrations within the CSA program are particularly well-suited to current and projected market demands. The incorporation of business courses builds upon a proven model for success, while the Health concentration will train future healthcare professionals to effectively integrate technology into patient care. Furthermore, the Psychology concentration is exceptionally prescient. With the rise of AI and the growing importance of user interface and experience design, professionals who understand the human element within technological frameworks are essential. This concentration addresses a critical need at the intersection of these two disciplines.

I commend UCR for developing a sustainable model for this new program and am excited to witness its growth. I am confident that the CSA program will create valuable opportunities for UCR students.

Sincerely,

Tony Givargis
Professor and Chair
Department of Computer Science

Round 1 Documents

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February 18, 2025

Neftali Watkinson Medina, PhD
Assistant Professor of Teaching
Computer Science & Engineering, UC Riverside

Re: Proposal for a major Computer Science Applications

Dear Dr. Watkinson Medina:

I am writing to express my strong support for the proposed Bachelor of Science in Computer Science Applications at UC Riverside, particularly the Health Science concentration. As a surgeon specializing in Trauma, Burns, Critical Care, and Acute Care Surgery, I have seen firsthand the immense potential of advanced computing—particularly artificial intelligence (AI), machine learning, and data science—in transforming healthcare research, improving patient outcomes, and optimizing healthcare delivery.

Healthcare today is increasingly driven by data, yet there remains a significant gap between frontline healthcare providers and the advanced computational tools that can enhance efficiency, precision, and patient-centered care. The integration of computer science principles into health sciences education will prepare future healthcare professionals to bridge this divide, equipping them with the skills necessary to lead innovations in clinical decision support, predictive analytics, workflow optimization, and electronic health record (EHR) enhancements.

A program like the B.S. in Computer Science Applications with a Health Science concentration is not only timely but essential. By providing students with strong foundations in computational methods alongside rigorous health sciences training, UC Riverside will be cultivating the next generation of clinician-scientists, informaticians, and healthcare leaders who can effectively leverage technology to drive meaningful improvements in patient care, provider well-being, and healthcare system performance.

Personally, I have a deep interest in the application of AI and data science in healthcare but often find that I lack the formal training to independently lead such initiatives. I firmly believe that programs like this will empower future healthcare professionals to take on leadership roles in advancing medical research, quality improvement, and healthcare innovation.

I commend UC Riverside for its forward-thinking approach in designing this interdisciplinary major and strongly encourage its approval and implementation. This program aligns with the evolving needs of healthcare and will position UC Riverside as a leader in training professionals at the intersection of medicine and technology.

Thank you for considering this vital initiative. I would be happy to provide any further insights or assistance as needed.

Sincerely,

Victor C. Joe, MD, MBA, FACS
Clinical Professor & Vice Chair for Quality, UC Irvine Department of Surgery
Vice President, UCI Health Medical Staff

February 2, 2025

Dear UCR Curriculum Committee:

I am writing a letter in support of for the new undergraduate major “Computer Science Applications” (CSA), which will be administered by the Department of Computer Science and Engineering (CSE).

Before providing more detail, I will first give you the background with which to interpret this letter. I am currently a professor, and the founding executive director of the Center for Inclusive Computing at Northeastern University. From 2014-2021 I served as the dean of the Khoury College of Computer Sciences at Northeastern University (with over 6500 students Khoury is one of the largest colleges of computing in the country). In my role as dean, I oversaw the addition of 30 new undergraduate interdisciplinary computing majors at Northeastern. I am a fellow of the ACM, AAAI and AAAS.

In this letter I will first discuss the quality of the proposed new major and how it fits in with other majors on campus, and then provide context on the potential graduate school and job outcomes for students who major in CSA.

UCR has a history with CSA degrees having operated the current CS with Business Applications major for many years. The new CSA degree will be inclusive of the CSBA major and is similar in its design. The difference between the within-discipline CS major and the CSA majors are the addition of concentrations in other fields and the removal of some higher-level math and physics courses in addition to the CS Theory courses (which are only needed for students choosing to go on to graduate schools in CS in the area of Theory – indeed most CS departments no longer require these courses even for within-discipline majors).

Administering the CSA within one department/college makes sense as these majors get started. Indeed when Northestern’s CS College (now called Khoury) started interdisciplinary computing degrees in 2001 all degrees were housed in the College. Looking at the CS requirements, UCR follows the typical first courses required for CS majors everywhere (introduction to programming 1, instrucution to programming 2, and data structures. In addition, students are required to take CS 061 (Computer Architecture), CS 100 (Software Engineering), CS 111 (Discrete Structures), CS 105 (Data Analysis), CS 141 (Algorithms), CS 153 (Operating Systems) and to complete a two-semester project. These courses will allow students to learn the core of CS and to pass technical interviews with tech firms. In addition, students must take 20 technical electives. This will allow them to customize what they learn in CS to match the other discipline. This structure is very similar to that used at Northeastern and UIUC (the other university to implement interdisciplinary computing majors at scale – UIUC has 15 such majors as of 2024). I cannot comment on the concentration area requirements as I am not an expert in any of these fields. But the number of units seems very reasonable to allow students to learn enough of the concentration discipline to understand the complexities and breadth of that field.

In terms of fit with other majors. The CSA allows students to take a different view of CS than the within-discipline major and will appeal to students who are interested in how CS can be applied to other fields. It is not in competition with any other majors to the best of my ability to assess this at another university.

In terms of student outcomes in the proposed CSA major, I turn to my experience as dean of Khoury College of Computer Sciences at Northeastern University. Currently more than half of Khoury's 3500 undergraduate students are pursuing combined computing majors—"combined majors" is Northeastern's name for interdisciplinary degrees. Although our degrees differ a bit in structure from the proposed degrees, the purpose and motivation is similar – in 2025 computer science is critically important for most other fields. We have tracked Northeastern's co-op placement for a decade (our students spend one to three six-month periods on internships as part of their undergraduate degree). We have 89% placement for within-discipline CS majors and 90% placement for combined computing majors. In terms of outcomes post graduation, in December of 2021 we tracked all 2021 graduates for Khoury College and found that placement was in the mid-90's and that there was no difference in placement rates between combined and within-discipline majors. There was a difference in where they were working, with both groups working in tech firms, but combined majors sometimes choosing to work at the juncture of the two disciplines (e.g., a Bio-CS major might work at a pharmaceutical firm). We also have tracked placement in graduate school and find that the only difference is that combined majors sometimes choose the other field to do advanced work (e.g., a Business-CS major choosing an MBA).

In conclusion, CSA's are an exciting step forward in a world in which the problems that need solving are increasingly interdisciplinary.

Sincerely,

Professor, Khoury College of Computer Sciences
Dean of Inclusive Computing,
Founding Executive Director, Center for Inclusive Computing,
Northeastern University

UNIVERSITY OF CALIFORNIA
UC RIVERSIDE

DEPARTMENT OF ECONOMICS

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March 17, 20245

To Whom it May Concern,

This letter is intended to communicate the support of the Economics Dept. for the new Computer Science Applications (CSA) major. The major has the support of the Chair and Undergraduate Advisory Committee (UAC) that I Chair. The Economics Dept. believes the new CSA major will be beneficial to the University and potentially synergistic with the Economics Department going forward.

The CSA major will have as pre-requisites a number of foundational Economics courses (2, 3 and 101). Since the CSA major will replace the existing Computer Science with Business Applications major, it is not likely to directly and immediately alter enrollment in the specific core Economics courses listed as pre-requisites in the short term.

However, we also believe that the new arrangement with computer science is likely to increase cross-disciplinary interest in several current and new Economics courses for CS majors. In particular, the Economics Dept. is currently developing several advanced quantitative courses as part of our proposed Quantitative Economics major, and we believe these courses are likely to see increased demand from CS students who have been exposed to Economics via the CSA major. These courses, including at least one newly approved course in Machine Learning for Economics and Business (Econ 111), will require as a pre-requisite Econ 107 (which has Econ 101 as a pre-requisite). The department anticipates long-term increased demand for such applied econometrics courses (107, 111, and other new courses) stemming from a combination of: a) increased interest in advanced quantitative analysis courses from CSA majors in the short-medium term, and b) increased interest in the CSA major (relative to the current major) in the medium-long term.

The Economics Department, as represented by the Chair and the UAC, fully support the creation of the CSA major, and look forward to continuing to train CS majors in core economic and econometrics principles, and in advanced quantitative methods beyond the core major requirements.

Sincerely,

Joseph Cummins
Associate Professor of Economics