General Curriculum Report #288

UNIVERSITY OF IDAHO – OFFICE OF THE REGISTRAR
MARCH 27, 2017

TO: MEMBERS OF THE UNIVERSITY OF IDAHO FACULTY

The items listed below, approved by the University Curriculum Committee, will be considered to have the necessary faculty approvals unless a petition requesting further consideration of specific items is signed by five faculty members and submitted to the chair of the Faculty Senate within 14 calendar days after the date of circulation. If no petition is received within 14 days, the entire report will be submitted to the president for approval and transmittal to the regents, if regents' action is required. If a petition is received, the items in the report for which further consideration is requested will be referred to the Faculty Senate and the remainder of the report will move forward. On items referred to it, the council may: (1) affirm the action and report it to a meeting of the university faculty, (2) amend the action and report it to a meeting of the university faculty, or (3) rescind the action. *Note:* If a petition concerns courses or curricula in the College of Letters, Arts and Social Sciences or in the College of Agricultural and Life Sciences, and is signed by five faculty members of the respective college, those items will be returned to the college concerned for further consideration.

All Items below are considered effective Summer 2017 unless otherwise noted with the approved item.

COLLEGE OF ART AND ARCHITECTURE

ARCHITECTURE

1. Add the following course:

   ARCH 256 Architectural Design Bootcamp (10 cr)
   Intensive introduction to various design processes from concept to schematic to design development. Acquisition of a beginning level of both graphic and architectural design literacy, design thinking strategies, aesthetic awareness. Development of basic design communication skills and introduction and application of construction technologies through component resolution.
   Prereq: Architecture Permission

2. Change the following courses:

   ARCH 243 Media in Architecture (3 cr)
   Introduction to techniques for hybridizing manual & digital design tools for workflows relative to the architectural design process; includes virtual modeling, CNC fabrication, 2D/3D printing, manual drafting, manual modeling, various software. Two 75 minute sessions per week; in class lectures & workshops; tools, techniques, & exercises integrated with Arch 253
   Coreq: ~~ARCH 253~~ARCH 254

   ARCH 253 Architectural Design I (4 cr)
   Introduction to Architectural Design Fundamentals including formal principles, ordering systems, conceptualization, experimentation, design making, & design communication for the resolution of given architectural design problems. Two 3-hr studio sessions per wk; course includes lectures, workshops, project development, presentations, readings.
   ~~**Coreq:** ARCH 243~~

ARCH 254 Architectural Design II (4 cr)
Same as ID 254. Basic integration of principles and concepts for architectural design, both interior & exterior. Two 3-hr studios a wk and assigned work.
Prereq: ARCH 253 or Permission
Coreq: ARCH 243

ARCH 461 Building Assemblies (3 cr)
Advanced building construction with focus on building enclosure systems and assemblies.
Prereq: ARCH 362, ARCH 463, or Instructor permission
~~**Coreq:** ARCH 463~~

3. Drop the following courses:

ARCH 367 Building Technology I - Steel Structures (3 cr)
Steel structures. Expansion of basic statics and bending theory to include two-dimensional systems and loading as well as more complicated beam loading and support configurations. Analysis of statically determinate steel structures by ASD and LRFD.
Prereq: Math 143 and Phys 111/111L

ARCH 450 Architectural Programming (2 cr)
Introduction to basic principles and techniques of building programming. Recommended Preparation: Third or fourth year standing.
Prereq: Arch 353

ARCH 453 Architectural Design V (6 cr)
Gen Ed: Senior Experience
Application of urban theory and appropriate responses to climatic factors to the resolution of architectural and planning and design problems in community or urban contexts. Interdisciplinary design encouraged. Three 3-hr studios a wk and assigned work; field trips reqd at student expense outside scheduled hours; some class critique sessions meet outside of scheduled hours.
Prereq: ARCH 353 and ARCH 354; or Permission

ARCH 462 Building Technology II - Concrete (2 cr)
Concrete Structures. Statics/strengths, allowable stresses and `prescriptive' and 'engineered' design approaches, factors of safety, ductility, Strength Design (LRFD) as applied to reinforced concrete structures.
Prereq: ARCH 367

ARCH 466 Building Technology III - Seismic Design (2 cr)
Lateral and dynamic loads on architectural structures, principles of design for wind and seismic resistance, high-rise structural systems.
Prereq: ARCH 367

ARCH 581 Eco Urban Design (3 cr)
Introduction to urban design including urban space and form, building configuration and form, transportation, ecological, environmental and social considerations and issues. Three hours per wk and assigned work; field trips may be reqd at student expense; some class sessions will meet outside of scheduled hours. Recommended Preparation: ARCH 483. (Fall only)

ARCH 582 Housing Typologies and Issues (3 cr)
Introduction to housing typologies and issues in the urban context, considering aspects of physical, infrastructural, sociological, economic, cultural, historical, political, regulatory environments and construction. Three hours per wk and assigned work; field trips may be reqd at student expense; some class sessions will meet outside of scheduled hours. Recommended Preparation: Arch 483.

ARCH 583 Sustainable Development (3 cr)
This seminar explores concepts and strategies for sustainable development that are holistic, transdisciplinary, and integrated. Scale and scope of critical inquiry ranges from the local Palouse region to global contexts with particular emphasis on impacts imposed by developed nations. Weekly readings, student led discussion and team research projects require active engagement. (Spring, alt/yrs)

ARCH 584 Urban Design and Morphology (3 cr)
Seminar style course that explores the theory, research, documentation and interpretive practices of urban morphology (study of urban form) and application to the design and planning of urban environments. Through case studies students will interpret the physical structure of urban contexts and forces that impact their formal transformation over time. Field Trip and field documentation activities required. Recommended preparation: Arch 483, background in architecture or the related fields of landscape architecture, geography and anthropology. (Spring only)

4. Make the following curricular changes to the **Architecture Major** (B.S.):

ARCH 151	Introduction to the Built Environment	3 cr
ARCH 154	Introduction to Architectural Graphics	3 cr
ARCH 243/ ID 243	Media in Architecture	3 cr
ARCH 253	Architectural Design I	4 cr
ARCH 254/ ID 254	Architectural Design II	4 cr
ARCH 266	Materials and Methods	3 cr
ARCH 353	Architectural Design III	6 cr
ARCH 354	Architectural Design IV	6 cr
ARCH 361	Structural Systems I	3 cr
ARCH 362	Structural Systems II	3 cr
ARCH 385	Global History of Architecture I	3 cr
ARCH 386	Global History of Architecture II	3 cr
ARCH 388	Architectural Theory	3 cr

ARCH 453	Architectural Design V	6 cr
ARCH 454	Architectural Design: Vertical Studio	6 cr - Max 12 cr
ARCH 461	Building Assemblies	3 cr
ARCH 463	Environmental Control Systems I	3 cr
ARCH 463L	Environmental Control System I Lab	1 cr
ARCH 464	Environmental Control Systems II	3 cr
ARCH 464L	Environmental Control System II Lab	1 cr
ARCH 483	Urban Theory and Issues	3 cr
ART 110	Integrated Art and Design Communication	2 cr
ART 112	Drawing as Integrated Design Thinking	2 cr
ART 121	Integrated Design Process	2 cr
LARC 251	Intro Principles of Site Dsgn	3 cr
~~MATH 143~~	~~Pre-calculus Algebra and Analytic Geometry~~	~~3 cr~~
PHYS 111	General Physics I	3 cr
PHYS 111L	General Physics I Lab	1 cr

One of the following (3-4 cr):

CS 112	Computational Thinking and Problem Solving	3 cr
MATH 160	Survey of Calculus	4 cr
MATH 170	Analytic Geometry and Calculus I	4 cr
MATH 175	Analytic Geometry II	4 cr
PHIL 202	Introduction to Symbolic Logic	3 cr
STAT 251	Statistical Methods	3 cr

Courses to total 124 credits for this degree (including at least 3 cr of 200-level or above courses taken outside the disciplines of architecture; landscape architecture; art and design; interior design; and virtual technology and design; and 3 cr of 200-level or above courses taken within the disciplines; and at least 3 credits of 200-level or above courses taken in any discipline. Credits earned in completion of an academic minor may be substituted).

5. Make the following curricular changes to the **Major in Architecture** (M.Arch.):

Graduate Architecture Electives selected from the following (6 cr):

ARCH 502	Directed Study	1-16 cr
ARCH 504	Special Topics	1-16 cr
ARCH 511	Native American Architecture	3 cr
ARCH 512	Identity and Place in Global Space	3 cr
ARCH 513	Architectural Theory: Modernism into Postmodernism	3 cr
ARCH 520	Architectural Research Methods	3 cr
ARCH 521	China Program Preparation Seminar	2 cr
ARCH 522	China's Urbanization Seminar	2 cr
ARCH 523	Cultural & Ethical Issues in Global Architectural Practice	2 cr
ARCH 570	Natural Lighting	3 cr
ARCH 571	Building Performance Evaluation	3 cr
ARCH 572	Integrated Design Seminar	1 cr - Max 4 cr
ARCH 573	Daylight Design and Simulation	3 cr
ARCH 574/	Building Performance Simulation for Integrated Design	3 cr

ME 571		
ARCH 580	British Green Architecture	2 cr
~~ARCH 581~~	~~Eco Urban Design~~	~~3 cr~~
~~ARCH 582~~	~~Housing Typologies and Issues~~	~~3 cr~~
~~ARCH 583~~	~~Sustainable Development~~	~~3 cr~~
~~ARCH 584~~	~~Urban Design and Morphology~~	~~3 cr~~
ARCH 585	Urban Design Seminar	3 cr
ARCH 599	Non-thesis Master's Research	1-16 cr

ART AND DESIGN

1. Add the following course:

ART 411 Advanced Studio Practice (3 cr, max 6)
Faculty directed advanced studio practices in a variety of media. Two 3-hr studios a wk and assigned work. Additional requirements will be assigned for graduate students.
Prereq: Art Core and by Permission

2. Change the following courses:

ART 360 Intermediate/Advanced Ceramics (3 cr, max 9)
Intermediate and Advanced level studio environment with further exploration of ceramic methods including wheel-thrown building techniques, kiln and studio procedures, creative autonomy, portfolio development, and comprehension of historical and contemporary issues relevant to studio projects and ceramics discourse. Two 3-hr studios a wk and assigned work.
Prereq: Art Core and ART 261; or Permission

ART 370 Intermediate/Advanced Interaction + Experiential Design (3 cr, max 9)
Advanced analysis of interaction and experiential design and development strategies and methodologies. Emphasis on individual development in conceptual and technical abilities. Collaboration, installation and exhibition of work outside of class may be assigned. Two 3-hr studios a week and assigned work.
Prereq: Art Core and ART 271 or ART 272; or Permission

ART 390 Mixed Media (3 cr, max 9)
Understanding synthesis of different media in context to a work of art by using two or more techniques; tutorial-based studio, production to occur outside of class. Outside lec and special events may be assigned.
Prereq: Art Core, 9 cr of 200-level art studios~~, and 6 cr of 300-level art studios~~ or Permission

3. Make the following curricular changes to the **Major in Art** (B.A.):

300-level studio courses selected from the following (15 cr):

ART 321	Graphic Design Concepts	3 cr - Max 6 cr

ART 322	Graphic Design Studio	3 cr - Max 6 cr
ART 330	Intermediate/Advanced Painting	3 cr - Max 12 cr
ART 340	Intermediate/Advanced Sculpture	3 cr - Max 9 cr
ART 350	Intermediate/Advanced Printmaking	3 cr - Max 9 cr
ART 360	Intermediate/Advanced Ceramics	3 cr - Max 9 cr
ART 370	Intermediate/Advanced Interaction + Experiential Design	3 cr - Max 9 cr
ART 380	Digital Imaging	3 cr
ART 390	Mixed Media	3 cr - Max 9 cr
ART 411	Advanced Studio Practice	3 cr – Max 6 cr
ART 491	Information Design	3 cr

Note: At least 6 credits must be taken in one studio area, i.e., ART 330; no more than 6 credits in one studio area may be counted toward this requirement.

INTERIOR DESIGN

1. Change the following course:

ID 344 Digital Design Tools for Interior Design (~~1~~2 cr)
Introduction to software programs, with emphasis on Revit, for use in designing environments. Including but not limited to 3-D modeling. ~~Meets once per week.~~
Coreq: ID 351 or Permission

2. Make the following curricular changes to the **Major in Interior Design** (B.I.D.):

~~College~~Program(s) permission is required for admittance into Architecture and Interior Design studio courses (ARCH 253, ARCH 254, and ID 152, ID 254, ID 351, ID 352, ID 451, ID 452) and students must achieve a minimum grade of C in the previous Interior Design studio course to enroll in the next sequential studio course.

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Courses to total ~~125~~126 credits for this degree

LANDSCAPE ARCHITECTURE

1. Add the following courses:

LARC 481 Urban Systems in Ecology (3 cr)
This course is designed to introduce upper division students of Landscape Architecture and other related disciplines to the principles, theories and processes of urbanism with a focus on sustainability and the integration of natural systems both as metaphor and physical design process.

LARC 450 Landscape Architecture Studio 1 (3 cr)
See LARC J353/J450/J550.

LARC 452 Landscape Architecture Studio 2 (3 cr)
See LARC J355/J452.

LARC 454 Landscape Architecture Studio 3
See LARC J363/J454/J552.

LARC 456 Landscape Architecture Studio 4 (3 cr)
See LARC J365/J456.

LARC 464 Landscape Construction 1 (2 cr)
See LARC J268/J464.

LARC 466 Landscape Construction 2 (2 cr)
See LARC J269/J466.

LARC 468 Landscape Architecture Construction 3 (2 cr)
See LARC J368/J468.

LARC 469 Landscape Architecture Construction 4 (2 cr)
See LARC J369/J469.

LARC 488 Plant Materials and Design 1 (3 cr)
See LARC J288/J488.

LARC 489 Plant Materials and Design 2 (3 cr)
See LARC J289/J489.

LARC 490 Italian Hill Towns and Urban Centers (3 cr)
See LARC J390/J490

LARC 552 Summer Study Abroad Design Studio (6 cr)
See LARC J364/J552.

LARC 553 Site Integration Studio (3 cr)
Graduate landscape architecture students work with graduate architecture students in the ARCH 553 Comprehensive building design studio to provide disciplinary expertise for site context, planning and design. The collaborative process emphasizes and mirrors interdisciplinary design processes that occur in a professional practice setting.

LARC 555 Master's Project Prep (2 cr)
This course guides students through the process of identifying a specific project, and developing a proposal, scope and timeline for their Masters Project. Students will prepare a research report to support their Masters Project, utilizing literature review and case study research methods. Progress

is reviewed in weekly peer presentations, giving students practice in developing professional level graphic and verbal presentations.

VIRTUAL TECHNOLOGY AND DESIGN

1. Add the following courses:

VTD 380 Advanced Character Design (3 cr)
Exploration of advanced workflows and methods for entertainment focused character design. This course will cover advanced digital painting techniques and basic image compositing in Photoshop while also covering digital sculpting and rendering using Zbrush. One (3 hour) lecture/lab with associated work.
Prereq: Instructor Permission

2. Make the following curricular changes to the **Major in Virtual Technology and Design** (B.S.):

ART 110	Integrated Art and Design Communication	2 cr
ART 112	Drawing as Integrated Design Thinking	2 cr
ART 121	Integrated Design Process	2 cr
CS 112	Computational Thinking and Problem Solving	3 cr
~~MATH 143~~	~~Pre-calculus Algebra and Analytic Geometry~~	~~3 cr~~
PHYS 111	General Physics I	3 cr
PHYS 111L	General Physics I Lab	1 cr
VTD 151	Virtual World Building 1	2 cr
VTD 152	Virtual World Building 2	2 cr
VTD 153	Virtual World Building 3	2 cr
VTD 154	Virtual World Building 4	2 cr
VTD 245	Advanced Modeling	3 cr
VTD 246	Advanced Lighting and Materials	3 cr
VTD 253	Virtual Design I	3 cr
VTD 254	Virtual Design II	3 cr
VTD 271	Interactive Technologies	3 cr
VTD 355	Virtual Design III	4 cr
VTD 356	Virtual Design IV	4 cr
VTD 367	Advanced Animation	3 cr
VTD 372	Advanced Interactive Technologies	3 cr
VTD 400	Seminar	1-16 cr
VTD 457	Capstone Design Studio I	6 cr
VTD 458	Capstone Design Studio II	6 cr

One of the following (3-4 cr):

MATH 143	Pre-calculus Algebra and Analytic Geometry	3 cr
MATH 160	Survey of Calculus	4 cr
MATH 170	Analytic Geometry and Calculus I	4 cr
MATH 175	Analytic Geometry and Calculus II	4 cr

History or Theory Courses (6 cr):

Two History or Theory Courses 6 cr

Must be associated with the disciplines of architecture, art, film, media, music or theatre, with approval of the VTD program.

Directed Electives (8-9 cr):

Three Directed Elective Courses 8-9 cr

Elective Courses that allow a student to develop an emphasis area or breadth in a supporting discipline, with approval of VTD program.

Courses to total 120 credits for this degree

COLLEGE OF BUSINESS AND ECONOMICS

COLLEGE OF BUSINESS AND ECONOMICS

1. Make the following changes to the **General College Requirements for Graduation:**

Before proceeding to upper-division work, students majoring in the College of Business and Economics (CBE) must have good academic standing.

Undergraduate students enrolled as majors in the College of Business and Economics may not take any course required for the major on a pass/fail basis, with the exception of those courses offered only on a P/F basis.

Courses completed at a two-year college for transfer into the CBE core or major must be validated before they will be accepted for upper-division course requirements. Validation procedures are established by the faculty members of the CBE department offering these courses. Validation techniques include a proficiency examination, CLEP testing, or successful completion of an additional advanced course in the given field.

Candidates for the B.S.Bus. degree must be accepted officially as majors in the College of Business and Economics for at least their last two semesters before graduation, excluding summer sessions, and complete at least the last 24 credit hours applicable toward their degree during this period.

At least 27 upper division College of Business and Economics credits applied to a B.S. Bus. Degree must be earned in residence on the University of Idaho campus. In addition, at least 12 upper division credit hours of the course requirement in the major must be earned on the UI campus.

All majors require the completion of at least 120 credit hours with the exception of the ~~Marketing,~~ PGA Golf Management ~~Option Major~~ options under Economics, Finance, Management and Human Resources, Management Information Systems, Marketing and Operations Management majors which requires completion of at least 128 credit hours. The

required program of study includes: (A) 54-57 credit hours in the CBE Common Requirements, and (B) the major-specific required credit hours in the selected CBE major field. Additional undesignated electives are included in the 120 required credit hours (or 128 required credit hours in the case of the ~~Marketing,~~ PGA Golf Management options ~~Option major~~).

BUSINESS

1. Make the following curricular changes to the **Major in Management and Human Resources** (B.S.Bus.):

BUS 411	Acquiring Human Capital	3 cr
BUS 417	Deploying and Developing Human Capital	3 cr

And one of the following emphases:
A. Management Emphasis

Management Elective:
Select one of the following courses (3 cr):

BUS 416	Developing and Managing Reward Systems	3 cr
BUS 418	Managing Organization Design and Leading Changes	3 cr
BUS 441	Maintaining Employee and Labor Relations	3 cr

Operations Management Elective:
Select one of the following courses (3 cr):

BUS 378	Project Management	3 cr
BUS 386	Food and Beverage Hospitality with Lab	4 cr
BUS 439	Systems and Simulation	4 cr
BUS 456/ STAT 456	Quality Management	3 cr
BUS 470	Supply Chain Management	3 cr
BUS 472	Operations Planning and Scheduling	3 cr
INDT 362	Behavior Based Safety	3 cr
PSYC 446	Engineering Psychology	3 cr

Marketing and Entrepreneurship Elective:
Select three or four credits from ~~one of~~ the following courses ~~(3 cr)~~:

AGEC 333	Introduction to Sales	3 cr
BUS 251	PGA Golf Management II	2 cr
BUS 324	Consumer Behavior	3 cr
BUS 385	PGA Golf Management III	2 cr
BUS 414	Entrepreneurship	3 cr
BUS 415	New Venture Creation	3 cr
BUS 420	Promotional Strategy	3 cr
BUS 421	Marketing Research and Analysis	3 cr

BUS 422	Personal Selling and Sales Force Management	3 cr
BUS 424	Pricing Strategy and Tactics	3 cr
BUS 425	Retail Distribution Management	3 cr
BUS 426	Marketing Channels Management	3 cr
BUS 427	Services Marketing	3 cr
BUS 482	International Marketing	3 cr
BUS 495/ RMAT 495	Product Development and Brand Management	3 cr

Accounting and Finance Elective:
Select one of the following courses (3 cr):

ACCT 305	Accounting Information Systems	3 cr
ACCT 315	Intermediate Financial Accounting I	3 cr
ACCT 385	Cost and Management Accounting	3 cr
ACCT 440	Fraud Examination	3 cr
ACCT 482	Enterprise Accounting	3 cr
ACCT 483	Fundamentals of Federal Taxation	3 cr
BUS 302	Intermediate Financial Management	3 cr
BUS 381	International Finance	3 cr
ECON 407	Public Finance	3 cr

Information Systems Elective:
Select one of the following courses (3 cr):

BUS 353	Application Development	3 cr
BUS 355	Systems Analysis & Administration	3 cr
BUS 452	Business Telecommunications Management	3 cr
BUS 453	Database Design	3 cr
BUS 454	Issues in Information Systems	3 cr
GEOG 385	GIS Primer	3 cr
MIS 455	Data Management for Big Data	3 cr

Courses to total 120 credits for this degree

B. Human Resources Management Emphasis

BUS 416	Developing and Managing Reward Systems	3 cr
BUS 418	Managing Organization Design and Leading Changes	3 cr
BUS 441	Maintaining Employee and Labor Relations	3 cr

HR Decision-Making Elective:
Select one of the following courses (3-4 cr):

ACCT 385	Cost and Management Accounting	3 cr
ACCT 482	Enterprise Accounting	3 cr
BUS 353	Application Development	3 cr
BUS 355	Systems Analysis & Administration	3 cr

BUS 421	Marketing Research and Analysis	3 cr
BUS 439	Systems and Simulation	4 cr
BUS 453	Database Design	3 cr
ECON 453/ STAT 433	Econometrics	3 cr
GEOG 385	GIS Primer	3 cr
MIS 455	Data Management for Big Data	3 cr
ORGS 444	Methods and Analysis in Organizational Science	4 cr
PSYC 218	Introduction to Research in the Behavioral Sciences	4 cr
PSYC 416	Industrial/Organizational Psychology	3 cr
PSYC 430	Tests and Measurements	3 cr

Specialized Electives:

Select three or four credits from one of the following courses ~~(3 cr)~~:

AOLL 560	Career Development in Organizations	3 cr
BUS 251	PGA Golf Management II	2 cr
BUS 385	PGA Golf Management III	2 cr
BUS 454	Issues in Information Systems	3 cr
COMM 347	Persuasion	3 cr
COMM 410	Conflict Management	3 cr
COMM 355	Organizational Communication	3 cr
CTE 472	Teaching and Learning in Occupation Education	3 cr
ECON 441	Labor Economics	3 cr
EDCI 301	Lrng, Dvlpmnt, & Assessment	3 cr
INDT 362	Behavior Based Safety	3 cr
INTR 316/ ORGS 317/ PSYC 317/ SOC 316	Explore Mentoring & Leadership	3 cr
JAMM 350	Public Relations Writing and Production	3 cr
ORGS 305	Nonprofit Organizations	3 cr
POLS 451	Public Administration	3 cr
PSYC 390	Psychology of Learning	3 cr
PSYC 440	Psychology of Judgement and Decision Making	3 cr
PSYC 496	Applied Behavior Analysis	3 cr
PSYC 541	Human Relations in the Workplace	3 cr
SOC 301	Introduction to Diversity and Stratification	3 cr

Courses to total 120 credits for this degree

COLLEGE OF ENGINEERING

BIOLOGICAL ENGINEERING

1. Add the following courses:

BE 361 Transport Processes in Biological Systems (3 cr)
Heat and mass transfer processes applied to analysis of biological systems and related equipment and processes.
Prereq: ENGR 320, MATH 310

BE J421/J521 Image Processing and Computer Vision (3 cr)
Fundamentals of digital image processing, analysis, feature recognition, and computer vision applied to areas of Biological Engineering including agricultural, environmental and biomedical applications. This course covers camera model, digital image processing and image analysis techniques for computer vision. Additional project components required for graduate credit.
Prereq: (BE 242 and MATH 275) or permission

BE 521 Image Processing and Computer Vision (3 cr)
See BE J421/J521.

BE J453/J553 Northwest Climate and Water Resources Change (3 cr)
Examines the relationship between climate and water resources in the Northwest, including historical and potential changes, and comparisons with other US regions. Scientific literature is read and discussed. Quantitative tools are developed for modeling the process physics and conducting statistical analyses. Historical data are analyzed. Additional project components required for graduate credit.
Prereq: STAT 301 or permission

BE 553 Northwest Climate and Water Resources Change (3 cr)
See BE J453/J553.

2. Change the following courses:

BE 142 Introduction to Biological Engineering ~~Engineering for Living Systems~~ (2 cr)
An Introduction to biological engineering and the engineering principles used to solve ~~agricultural and~~ biological ~~systems~~ engineering problems~~, including use of computers~~. Fields of study within biological engineering will be discussed including agricultural, bioenergy, biomedical, bioprocess, ecohydrological and environmental engineering. Students will work on a team-based engineering project. One lec and one 3-hr lab a wk~~; two half-day field trips.~~

BE J441/J541 Instrumentation and Measurements (3 cr)
Sensing elements, signal conditioning, data output and control. Additional projects/assignments reqd for grad cr. Two lec and one 3-hr lab a wk. ~~Recommended Preparation: BE 462.~~ Cooperative: open to WSU degree-seeking students.
Prereq: ENGR 240
Coreq: STAT 301

3. Drop the following courses:

BE 451 Engineering Hydrology (3 cr)
See CE 421.

BE 458 Open Channel Hydraulics (3 cr)
See CE 428.

CIVIL ENGINEERING

1. Add the following courses:

CE J413/J513 Bridge Design (3 cr)
Structural systems for bridges, loading analysis by influence lines, slab and girder bridges, composite design, pre-stressed concrete, rating of existing bridges, specifications and economic factors.
Prereq: CE 442 or CE 444

CE 513 Bridge Design (3 cr)
See CE J413/J513.

2. Change the following courses:

CE 322 Hydraulics (~~3~~4 cr)
Applied principles of fluid mechanics; closed conduit flow, hydraulic machinery, open channel flow; design of hydraulic systems. Laboratory exercises on closed conduit flow, hydraulic machinery, open channel flow and mixing process. Three lec a week and 4-6 labs a semester.
Prereq: CE 215, MATH 310, PHYS 211, ENGR 220 and ENGR 335. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 421 Engineering Hydrology (3 cr)
~~Same as BE 451.~~ Hydrologic design including: statistical methods, rainfall analysis and design storm development, frequency analysis, peak discharge estimation, hydrograph analysis and synthesis, flow routing, and risk analysis.
Prereq: CE 325 or BE 355. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 428 Open Channel Hydraulics (3 cr)
~~Same as BE 458.~~ Hydraulics of uniform and varied flow in open channels with fixed and movable beds. Recommended Preparation: CE 322. Cooperative: open to WSU degree-seeking students.

CE 482 Project Engineering (3 cr)
Same as EM 482 and TM 482. Modern project engineering techniques for planning, scheduling, and controlling typical engineering and construction projects.~~,~~ ~~linear~~Linear programming and other optimization techniques as applied to resource allocation.~~; microcomputer~~ Computer applications are emphasized and appropriate software used throughout the course.
Prereq: ((STAT 251, STAT 301, or Equivalent~~,~~) and Senior standing) or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

CE 577 Pavement Preservation and Management ~~and Rehabilitation~~ (3 cr)
~~Overview of Pavement Management Systems; PMS project and network levels; serviceability concepts and performance models; PMS data needs; rehabilitation and maintenance strategies; life cycle cost analysis; implementation of PMS in design, construction, maintenance, and research; examples of working PMS; maintenance and rehabilitation of asphalt and concrete pavements. Cooperative: open to WSU degree-seeking students.~~ This course addresses several aspects of pavement evaluation, preservation, rehabilitation, and management. The primary objective of this course is to provide the civil engineering graduate students with state-of-the-art knowledge needed to maintain our roadways in serviceable condition. The course covers different methods used to evaluate the performance of pavements, distresses in flexible and rigid pavements, project and network level pavement management, various preservation and rehabilitation techniques and selection of the appropriate approaches for preservation and rehabilitation.
Prereq: CE 475 or Equivalent, or Permission. A minimum grade of 'C' or better is required for all pre/coreqs.

3. Make the following curricular changes to the **Civil Engineering Major** (B.S.C.E.):

CE 115	Introduction to Civil Engineering	1 cr
CE 211	Engineering Surveying	3 cr
CE 215	Civil Engineering Analysis and Design	3 cr
CE 322	Hydraulics	3 cr
CE 325/ BE 355	Fundamentals of Hydrologic Engineering	3 cr
CE 330	Fundamentals of Environmental Engineering	3 cr
CE 342	Theory of Structures	3 cr
CE 357	Properties of Construction Materials	4 cr
CE 360	Fundamentals of Geotechnical Engineering	4 cr
CE 372	Fundamentals of Transportation Engineering	4 cr
CE 491	Civil Engineering Professional Seminar	1 cr
CE 494	Senior Design Project	3 cr
CHEM 111	Principles of Chemistry I	4 cr
ENGL 317	Technical Writing	3 cr

ENGR 105	Engineering Graphics	2 cr
ENGR 210	Engineering Statics	3 cr
ENGR 220	Engineering Dynamics	3 cr
ENGR 335	Engineering Fluid Mechanics	3 cr
ENGR 350	Engineering Mechanics of Materials	3 cr
ENGR 360	Engineering Economy	2 cr
GEOL 111	Physical Geology for Science Majors	3 cr
GEOL 111L	Physical Geology for Science Majors Lab	1 cr
	OR	
GEOL 101L	Physical Geology Lab	1 cr
MATH 170	Analytic Geometry and Calculus I	4 cr
MATH 175	Analytic Geometry and Calculus II	4 cr
MATH 275	Analytic Geometry and Calculus III	3 cr
MATH 310	Ordinary Differential Equations	3 cr
PHYS 211	Engineering Physics I	3 cr
STAT 301	Probability and Statistics	3 cr
One of the following (3 cr):		
AMST 301	Studies in American Culture	3 cr
PHIL 103	Ethics	3 cr
One of the following (3-4 cr):		
ECON 201	Principles of Macroeconomics	3 cr
ECON 202	Principles of Microeconomics	3 cr
ECON 272	Foundations of Economic Analysis	4 cr
One of the following (3 cr):		
ENGR 240	Introduction to Electrical Circuits	3 cr
ENGR 320	Engineering Thermodynamics and Heat Transfer	3 cr
~~Two~~One of the following (~~8-9~~4-5 cr):		
BIOL 115	Cells & the Evolution of Life	3 cr
	AND	
BIOL 115L	Cells and the Evolution of Life Laboratory	1 cr
BIOL 154	Introductory Microbiology	3 cr
	AND	
BIOL 155	Introductory Microbiology Laboratory	1 cr
CHEM 112	Principles of Chemistry II	5 cr
PHYS 212	Engineering Physics II	3 cr
	AND	
PHYS 212L	Laboratory Physics II	1 cr

~~GEOL 111~~	~~Physical Geology for Science Majors~~	~~3 cr~~
	~~AND~~	
~~GEOL 111L~~	~~Physical Geology for Science Majors Lab~~	~~1 cr~~

~~*Note: Students may use CHEM 112 or PHYS 212/PHYS 212L, but not both.*~~

Technical Electives (21 cr):
To ensure sufficient breadth, technical electives must include at least 15 credits from at least three of the following five groups:

Environmental:

CE 431	Design of Water and Wastewater Systems I	3 cr
CE 432	Design of Water and Wastewater Systems II	3 cr
CE 433	Water Quality Management	3 cr

Geotechnical:

CE 460	Geotechnical Engineering Design	3 cr
GEOE 436	Geological Engineering Analysis and Design	3 cr

Hyd/Water Resources:

CE 421/ BE 451	Engineering Hydrology	3 cr
CE 422	Hydraulic Structures Analysis and Design	3 cr
CE 428/ BE 458	Open Channel Hydraulics	3 cr

Structures:

CE 441	Reinforced Concrete Design	3 cr
CE 444	Steel Design	3 cr
CE 445	Matrix Structural Analysis	3 cr

Transportation:

CE 474	Traffic Systems Design	3 cr
CE 475	Pavement Design and Evaluation	3 cr

Note: Other CE 400 level classes (except CE 411), or approved alternatives, may be used to complete the required 21 cr of tech electives.

Courses to total ~~128~~129 credits for this degree, not counting Math below 170, English below 102, and any classes needed to remove deficiencies.

COMPUTER SCIENCE

1. Reactivate the following dormant courses:

   CS J441/J541 Advanced Operating Systems (3 cr)
   Principles of contemporary operating systems for network and distributed computer systems; sequential processes, scheduling, process synchronization, device management, file systems, memory management, and protection and security. Additional work required for graduate credit.
   Prereq: CS 240

   CS 541 Advanced Operating Systems (3 cr)
   See CS J441/J541.

2. Add the following courses:

   CS J475/J575 Machine Learning (3 cr)
   Analysis and implementation of classic machine learning algorithms including neural networks, deep learning networks, principle component analysis, decision trees, support vector machines, clustering, reinforcement learning, ensemble learning, K-means, self-organizing maps and probabilistic learning such as Markov Chain Monte Carlo and Expectation Maximization algorithms. Techniques of preprocessing data, training, testing, and validating will be discussed along with statistical measures commonly used and pitfalls commonly encountered. Additional work required for graduate credit.
   Prereq: CS 210

   CS J479/J579 Data Science (3 cr)
   Data science is advancing the conduct of science in individual and collaborative works. Data science combines aspects of data management, library science, computer science, and physical science using supporting cyberinfrastructure and information technology. Key methodologies in application areas based on real research experience are taught to build a skill-set that enables students to handle each stage in a data lifecycle, from data collection, analysis, archiving, to data discovery, access and reuse. Additional work required for graduate credit.
   Prereq: MATH 330 or permission

   CS 579 Data Science (3 cr)
   See CS J479/J579.

3. Change the following course:

   CS ~~576~~575 ~~Data Mining Topics and Techniques~~ Machine Learning(3 cr)
   ~~This course will focus on the development of relevant tools, methods, and design of Knowledge from Data (KDD) Systems. Further, it will concentrate on the design and implementation of an advanced data mining system with expectations of optimal performance and flexibility.~~ See CS J475/J575.

4. Drop the following course:

CS 130 Programming with Visual Basic (3 cr)
Introduction to fundamental problem solving techniques using the computer and the object oriented, event driven language Visual Basic. The course introduces structured programming concepts; the use of fundamental data types, including arrays and database structures; and editing and program execution. Recommended Preparation: MATH 143.

ELECTRICAL AND COMPUTER ENGINEERING

1. Reactivate the following dormant courses:

ECE 555 Information Theory (3 cr)
Introduction to Shannon Theory; entropy, relative entropy, and mutual information; asymptotic equipartition; entropy rates of stochastic processes; data compression; channel capacity, differential entropy; the Gaussian channel, Lempel-Ziv coding, rate distortion theory.
Prereq: ECE 455 or Permission

ECE 574 Optimal Control Theory (3 cr)
Intro to optimization, parameter optimization, optimization of dynamic systems, optimization of dynamic systems with path constraints, optimal feedback control and dynamic programming, linear quadratic regulators, second variation methods, singular control problems, differential games. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 572 or Permission

2. Add the following courses:

ECE J475/J575 Resilient Control of Critical Infrastructure (3 cr)
This course establishes a perspective on the unique challenges of automation in our society and provides insight on how an industrial control system works and how it can fail due to threats from cyber security, human error, and complex interdependencies. It also introduces concepts from the resilient controls community that attempt to make industrial control systems more resilient to these threats. Furthermore, it provides background to the vocabulary and fundamental concepts related to the variety of disciplines required for the effective management, control, and protection of critical infrastructure. Additional work required for graduate credit. Cooperative: open to WSU degree-seeking students.

ECE 575 Resilient Control of Critical Infrastructure (3 cr)
See ECE J475/J575.

3. Change the following courses:

ECE 101 Foundations of Electrical and Computer Engineering (2 cr)
~~Course is geared toward freshmen ECE~~ Introductory course for incoming students with little or no fundamental electrical/computer engineering knowledge. ~~and is highly interactive and hands-on; includes introductory~~ Includes coverage of basic ~~signal characteristics, amplifier applications and design, fundamental circuit analysis, data analysis, digital logic and computer architecture, electromagnetics, semiconductor physics and solar cells, and VLSI, etc.; nontechnical topics relevant to freshmen will also be included.~~analog and digital circuits. Lab assignments also included.
Coreq: MATH 143 or MATH 170

ECE J412/J512 Analog Filter Design (3 cr)
Second order, Butterworth, Chebychev, Elliptic and Bessel filter functions and active realizations for highpass, lowpass, bandpass, notch and all-pass filters; frequency and impedance scaling; frequency transformations; phase and group delay; filter sensitivity to passive and active elements; introduction to switched capacitor filters. Additional projects/assignments reqd for grad cr. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 310 or Permission

ECE J413/J513 Radio-Frequency IC Design (3 cr)
Radio frequency (RF) communications concepts, integrated circuit (IC) transceiver architectures, low-noise amplifier, mixers, passive devices and matching networks, oscillators, power amplifiers, phase-locked loops, and frequency synthesizers. Additional projects/assignments are required for graduate students. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 410 or Permission

ECE J415/J515 Analog Integrated Circuit Design (3 cr)
Analog integrated circuit (IC) analysis, design, simulation, and layout, advanced biasing techniques, voltage references and regulators, operational amplifiers, frequency compensation techniques, noise analysis in analog circuits, and continuous-time integrated circuit filter design. Additional projects/assignments required for graduate credit. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 410 or Permission

ECE J417/J517 Pulse and Digital Circuits (3 cr)
Sample and hold (S/H) circuits, comparators, data-converter fundamentals, Nyquist-rate digital-to-analog converters (DAC) and analog-to-digital converters (ADC), over-sampling data converters, and phase-locked loops. Additional projects/assignments are required for graduate credit. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 410 or Permission

ECE J418/J518 Introduction to Electronic Packaging (3 cr)
This course serves as an introduction to electronic packaging and 'back-end' microelectronic processes. Topics include substrate design & fabrication, SMT & first level assembly, clean room protocol, thermal design, simulation, and process considerations. Additional project work will be required for students enrolled in 518. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 310

ECE J419/J516 Image Sensors and Systems (3 cr)
This course introduces various concepts and fundamentals related to semiconductor image sensors. Topics cover light production and detection, video image formats, image sensor characteristics and performance metrics, basic and advanced operation principals and types of semiconductor image sensors (CCD and CMOS), noise in imagers, image and color processing, and issues related to camera system design, integration and signal processing. Additional projects/assignments are required for graduate credit. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 310

ECE 520 Advanced Electrical Machinery (3 cr)
Synchronous machines and transformers, machine transient and subtransient reactances, excitation and voltage regulation, power curves, transformer connections, impedance, harmonics, and impulse characteristics. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 423

ECE 521 Power System Stability (3 cr)
Understanding, modeling, and analysis of power system transient and voltage stability; techniques for improving power system stability; use of computer tools. Cooperative: open to WSU degree-seeking students. (Alt/yrs)
Prereq: ECE 520 or Permission

ECE 522 Induction Machines (3 cr)
Winding theory, reference frame theory, induction machine models, complex vector methods, small signal analysis, induction machine capability, simulation, introduction to variable speed drives. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 350, ECE 423, or Permission

ECE 523 Symmetrical Components (3 cr)
Concepts of symmetrical components, sequence impedances of devices and lines, circuit equivalents for unbalanced faults, management during faults. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 422

ECE 524 Transients in Power Systems (3 cr)
Analysis and simulation of electromagnetic transients on electric power systems; switching transients; lightning transients; mitigation of transient overvoltages; surge protection; modeling power systems apparatus for transient studies. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 421

ECE 525 Power System Protection and Relaying (3 cr)
Power systems protection fundamentals; dynamic response of current voltage measurement devices; numerical relay fundamentals; review of symmetrical components; application of overcurrent elements, distance elements and differential elements for the real time protection and monitoring of transmission, distribution and generation apparatus. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 422 or Permission

ECE 526 Protection of Power Systems II (3 cr)
Protection of electrical equipment as related to electric power systems with emphasis on digital algorithms. Cooperative: open to WSU degree-seeking students.
Prereq: ECE 525 or Permission

4. Make the following curricular changes to the **Major in Computer Engineering** (B.S.Comp.E.):

CHEM 111	Principles of Chemistry I	4 cr
COMM 101	Fundamntls Public Speaking	2 cr
CS 120	Computer Science I	4 cr
CS 121	Computer Science II	3 cr
CS 150	Computer Organization and Architecture	3 cr
CS 210	Programming Languages	3 cr
CS 240	Computer Operating Systems	3 cr
CS 270	System Software	3 cr
ECE 101	Foundations of Electrical and Computer Engineering	2 cr
ECE 210	Electrical Circuits I	3 cr
ECE 211	Electrical Circuits Lab I	1 cr
ECE 212	Electrical Circuits II	3 cr
ECE 213	Electrical Circuits II Lab	1 cr
ECE 240	Digital Logic	3 cr
ECE 241	Logic Circuit Lab	1 cr
ECE 292	Sophomore Seminar	0 cr
ECE 310	Microelectronics I	3 cr
ECE 311	Microelectronics I Lab	1 cr
ECE 340	Microcontrollers	3 cr
ECE 341	Microcontrollers Lab	1 cr
ECE 350	Signals and Systems I	3 cr
ECE 351	Signals and Systems I Lab	1 cr
ECE 440	Digital Systems Engineering	3 cr
ECE 482	Computer Engineering Senior Design I	3 cr

ECE 483	Computer Engineering Senior Design II	3 cr
ECE 491	Senior Seminar	0 cr
ENGL 317	Technical Writing	3 cr
MATH 170	Analytic Geometry and Calculus I	4 cr
MATH 175	Analytic Geometry and Calculus II	4 cr
MATH 176	Discrete Mathematics	3 cr
MATH 310	Ordinary Differential Equations	3 cr
MATH 330	Linear Algebra	3 cr
PHYS 211	Engineering Physics I	3 cr
PHYS 211L	Laboratory Physics I	1 cr
PHYS 212	Engineering Physics II	3 cr
PHYS 212L	Laboratory Physics II	1 cr
STAT 301	Probability and Statistics	3 cr

~~**Science elective (3-4 cr):**~~

~~**Select one of the following:**~~

~~BIOL 154~~	~~Introductory Microbiology~~	~~3 cr~~
	~~AND~~	
~~BIOL 155~~	~~Introductory Microbiology Laboratory~~	~~1 cr~~
~~CHEM 111~~	~~Principles of Chemistry I~~	~~4 cr~~
~~GEOL 111~~	~~Physical Geology for Science Majors~~	~~3 cr~~
	~~AND~~	
~~GEOL 111L~~	~~Physical Geology for Science Majors Lab~~	~~1 cr~~
~~PHYS 213~~	~~Engineering Physics III~~	~~3 cr~~

Technical Electives (15 cr):

	Technical Electives	15 cr

Selected from upper-division computer engineering, electrical engineering, and computer science courses.

One of the following (3 cr):

AMST 301	Studies in American Culture	3 cr
PHIL 103	Ethics	3 cr

One of the following (3-4 cr):

ECON 201	Principles of Macroeconomics	3 cr
ECON 202	Principles of Microeconomics	3 cr
ECON 272	Foundations of Economic Analysis	4 cr

Courses to total 128 credits for this degree, not counting ENGL 101**,** MATH 143**, and other courses that might be required to remove deficiencies.**

Students majoring in computer engineering must earn a grade of C or better in each of the following courses for graduation, and before registration is permitted in upper-division engineering courses: ECE 210, ECE 212, ECE 240, ECE 241, MATH 170, MATH 175, MATH 310, PHYS 211, and PHYS 212. Before registration is permitted in 200-level CS courses students majoring in computer engineering must earn a grade of C or better in CS 120, CS 121 and CS 150 and MATH 176. Students majoring in computer engineering must earn a grade of C or better in CS 210, CS 240, CS 270, and MATH 170, MATH 175, MATH 176 for graduation and before registration is permitted in upper-division CS courses.

Any student majoring in computer engineering may accumulate no more than five (5) letter grades of D's and F's in mathematics, science, or engineering courses that are used to satisfy graduation requirements. Included in this number are multiple repeats of a single class or single repeats in multiple classes and courses transferred from other institutions. Specifically excluded are D or F grades from laboratory sections associated with courses.

5. Make the following curricular changes to the **Major in Electrical Engineering** (B.S.E.E.):

CHEM 111	Principles of Chemistry I	4 cr
CS 120	Computer Science I	4 cr
ECE 101	Foundations of Electrical and Computer Engineering	2 cr
ECE 210	Electrical Circuits I	3 cr
ECE 211	Electrical Circuits Lab I	1 cr
ECE 212	Electrical Circuits II	3 cr
ECE 213	Electrical Circuits II Lab	1 cr
ECE 240	Digital Logic	3 cr
ECE 241	Logic Circuit Lab	1 cr
ECE 292	Sophomore Seminar	0 cr
ECE 310	Microelectronics I	3 cr
ECE 311	Microelectronics I Lab	1 cr
ECE 320	Energy Systems I	3 cr
ECE 321	Energy Systems I Laboratory	1 cr
ECE 330	Electromagnetic Theory	3 cr
ECE 331	Electromagnetics Laboratory	1 cr
ECE 340	Microcontrollers	3 cr
ECE 341	Microcontrollers Lab	1 cr
ECE 350	Signals and Systems I	3 cr
ECE 351	Signals and Systems I Lab	1 cr
ECE 480	EE Senior Design I	3 cr
ECE 481	EE Senior Design II	3 cr
ECE 491	Senior Seminar	0 cr
ENGR 210	Engineering Statics	3 cr
ENGR 220	Engineering Dynamics	3 cr
ENGR 360	Engineering Economy	2 cr

ENGL 317	Technical Writing	3 cr
MATH 170	Analytic Geometry and Calculus I	4 cr
MATH 175	Analytic Geometry and Calculus II	4 cr
MATH 275	Analytic Geometry and Calculus III	3 cr
MATH 310	Ordinary Differential Equations	3 cr
MATH 330	Linear Algebra	3 cr
PHYS 211	Engineering Physics I	3 cr
PHYS 211L	Laboratory Physics I	1 cr
PHYS 212	Engineering Physics II	3 cr
PHYS 212L	Laboratory Physics II	1 cr
STAT 301	Probability and Statistics	3 cr

One of the following (3 cr):

AMST 301	Studies in American Culture	3 cr
PHIL 103	Ethics	3 cr

One of the following (3-4 cr):

ECON 201	Principles of Macroeconomics	3 cr
ECON 202	Principles of Microeconomics	3 cr
ECON 272	Foundations of Economic Analysis	4 cr

Upper-division Engineering Science Elective chosen from (3 cr)

ENGR 320	Engineering Thermodynamics and Heat Transfer	3 cr
ENGR 335	Engineering Fluid Mechanics	3 cr
ENGR 350	Engineering Mechanics of Materials	3 cr
ENGR 428/ MATH 428/ PHYS 428	Numerical Methods	3 cr

Technical Electives taken from upper-division Engineering, Math, Physics, Statistics, and Computer Science courses (18 cr).

Students may request, after approval by their academic advisor and the Petition Committee, to use other upper division technical courses in the College of Science or in Engineering Management (EM) in partial fulfillment of this requirement. Of these eighteen credits a minimum of twelve credits must be selected from electrical engineering courses including at least nine credits from the follow courses:

ECE 410	Microelectronics II	3 cr
	OR	
ECE 418	Introduction to Electronic Packaging	3 cr
ECE 420	Energy Systems II	3 cr
ECE 430	Microwave and Millimeter Wave Circuits	3 cr

ECE 432	Propagation of Wireless Signals	3 cr
ECE 434	Antenna Principles and Design	3 cr
ECE 440	Digital Systems Engineering	3 cr
	OR	
ECE 443	Distributed Processing and Control Networks	3 cr
ECE 450	Signals and Systems II	3 cr
ECE 460	Semiconductor Devices	3 cr
	OR	
ECE 465	Introduction to Microelectronics Fabrication	3 cr

~~*Technical Electives: Students may request, after approval by their academic advisor and the Petition Committee, to use other upper division technical courses in the College of Science or in Engineering Management (EM) in partial fulfillment of this requirement.*~~

Courses to total 128 credits for this degree, not counting ENGL 101**,** MATH 143**, and other courses that might be required to remove deficiencies.**

ENGINEERING MANAGEMENT

1. Add the following courses:

EM 482 Project Engineering (3 cr)
See CE 482.

EM 580 Technical Project Management (3 cr)
Traditional project management approaches are typically structured around the five PMBOK (Project Management Book of Knowledge) process groups. This course will introduce the PMBOK process groups but then discuss five different project management life cycle (PMLC) models to manage a project. The topics discussed are appropriate for new project managers but also for experienced project managers who are looking to increase their awareness and improve their skills in differing PMLC models.

2. Change the following course:

EM 582 Advanced Topics in Project Management (3 cr)
Discussion and application of advanced project management topics beyond those prescribed by traditional project management approaches. ~~Specific~~ Example topics include project portfolio management, multi-project management, use of Theory of Constraints (TOC) and Critical Chain approaches to drive improved results, and application of Agile practices ~~within an overall Waterfall life cycle model~~. These approaches should be applicable to a wide variety of industries and functions.
Prereq: ~~CE 482~~EM 580 or Instructor Permission

INDUSTRIAL TECHNOLOGY

1. Add the following course:

INDT 473 Fundamentals of Unmanned Aerial Systems (3 cr)
The course introduces students to unmanned aerial systems (UAS) and provides an overview of UAS types, applications, and operation considerations. The general principles of aerodynamics, propulsion, navigation and stability control applied to UAS are studied. The course provides an in-depth coverage of the main components integrated in both civilian and military UAS, such as payloads, ground control systems, communication data links, and launch/recovery systems.
Prereq: General Technical Background

2. Change the following courses:

INDT 484 Industrial Technology Capstone I (~~2~~3 cr)
This course is the first of two capstone courses. The students will select and develop a project that applies technology to a problem. Students are encouraged to incorporate service learning into the project and work in teams. Course will have 1 lecture hours and 2, 3 hour labs each week. Recommended preparation: senior standing.
Prereq: INDTT 442 and INDT 444

INDT 485 Industrial Technology Capstone II (~~2~~3 cr)
This course is second of the two capstone courses. The students will develop their project that applies technology to a problem. Students are encouraged to incorporate service learning into the project and to work in teams. Course will have 1 lecture hours and 2, 3 hour labs each week. Recommended preparation: senior standing.
Prereq: INDT 442 and INDT 444

3. Make the following curricular changes to the **Major in Industrial Technology** (B.S.Tech.)

The degree program requires ~~128~~122 credits and includes the university requirements (regulation J-3). There are ~~104~~98 credits of required courses and 24 credits of electives. Of the 24 elective credits 13 are technical electives and 11 free electives. The required courses for this program are:

BUS 311	Introduction to Management	3 cr
~~BUS 370~~	~~Process Management~~	~~3 cr~~
CE 482	Project Engineering	3 cr
CHEM 111	Principles of Chemistry I	4 cr
~~CHEM 112~~	~~Principles of Chemistry II~~	~~5 cr~~
ECON 202	Principles of Microeconomics	3 cr
ENGL 317	Technical Writing	3 cr
ENGR 105	Engineering Graphics	2 cr
INDT 310	Introduction to Industrial Technology	3 cr
INDT 311	Problems in Industrial Technology	1 cr
INDT 332	Introduction to Analog and Digital Electronics	4 cr

INDT 333	Industrial Electronics and Control Systems	3 cr
INDT 350	Introduction to Materials Science	3 cr
INDT 353	Manufacturing Systems	3 cr
INDT 362	Behavior Based Safety	3 cr
INDT 415	Impact of Technology on Society	3 cr
INDT 434	Power Generation and Distribution	3 cr
INDT 435	Network Administration	3 cr
INDT 442	Systems Integration	3 cr
INDT 443	Government Contract Law	3 cr
INDT 444	Quality Assurance Organization and Management	3 cr
INDT 446	Labor Law	3 cr
INDT 453	Computer Integrated and Robotics Manufacturing Technology	3 cr
INDT 462	Industrial Safety	3 cr
INDT 484	Industrial Technology Capstone I	2 cr
INDT 485	Industrial Technology Capstone II	2 cr
PHYS 111	General Physics I	3 cr
PHYS 111L	General Physics I Lab	1 cr
PHYS 112	General Physics II	3 cr
PHYS 112L	General Physics II Lab	1 cr
PSYC 101	Introduction to Psychology	3 cr

One of the following (4 cr):

MATH 160	Survey of Calculus	4 cr
MATH 170	Analytic Geometry and Calculus I	4 cr

One of the following (3 cr):

STAT 251	Statistical Methods	3 cr
STAT 301	Probability and Statistics	3 cr

Technical electives can include, but are not limited to:

INDT 448	Project and Program Management	3 cr
INDT 457	Lean to Green Sustainable Technology	3 cr
INDT 463	Industrial Transportation Safety	3 cr
INDT 464	Human Performance Fundamentals	3 cr
INDT 465	Construction Safety	3 cr
INDT 466	Human Performance Field Investigation	3 cr
INDT 468	Applied Research in Human Performance	3 cr
INDT 469	Safety Management through LEAN Engineering Methods	3 cr
INDT 470	Homeland Security	3 cr
INDT 472	National Incident Management Systems	3 cr

Elective credit can also be obtained through Technical Competency. Up to 24 credits can be obtained in this manner. Consult with your advisor for information on this process.

Courses to total ~~128~~122 credits for this degree

4. Make the following curricular changes to the **Human Safety Performance Undergraduate Academic Certificate:**

INDT 362	Behavior Based Safety	3 cr
INDT 464	Human Performance Fundamentals	3 cr
INDT 466	Human Performance Field Investigation	3 cr

One of the following (3 cr):

~~CTE 450~~	~~Occupational Safety~~	~~3 cr~~
INDT 462	Industrial Safety	3 cr
TM 528	Accident Investigation	3 cr

Courses to total 12 credits for this certificate

MECHANICAL ENGINEERING

1. Add the following courses:

ME 436 Sustainable Energy Sources and Systems (3 cr)
An introduction to renewable energy conversion. Topics include: solar thermal, solar photovoltaic, and wind energy. Cooperative: open to WSU degree seeking students.
Prereq: ME 345

ME J438/J538 Sustainability and Green Design (3 cr)
Understanding the Concept of Sustainability, Industrial Ecology and Sustainable Engineering, Metabolic Analysis, Sustainable Engineering, Design for Environment and Sustainability, Life Cycle Assessment, Energy & Water and Industrial Ecology, The status of Resources, Sustainable Engineering and Economics Development. Cooperative: open to WSU degree seeking students.
Prereq: MATH 310

ME 538 Sustainability and Green Design (3 cr)
See ME J438/J538.

ME J458/J558 Finite Element Applications in Engineering (3 cr)
The finite element method is an essential tool for the design and research activities performed in engineering companies and academic institutions. The goal of this course is to introduce students to the use of the finite element method by focusing on a range of engineering applications and employing an interactive commercial finite element code. Students will learn how to solve various problems from several mechanical engineering areas including solid mechanics, heat transfer and fluid mechanics. When available, analytical solutions will be compared with the finite element solutions for validation purposes. Cooperative: open to WSU degree seeking students (558 only).
Prereq: ME 322 (or ENGR 320) and ENGR 350
Coreq: ME 341 or instructor permission

ME 558 Finite Element Applications in Engineering (3 cr)
See ME J458/J558.

2. Change the following courses:

ME 412 Gas Dynamics (3 cr)
Compressible flow in ducts and nozzles, shock waves and expansion waves, and adiabatic two-dimensional compressible flow.
Prereq: MATH 310, (ME 322 or ENGR 320), and ENGR 335

ME J417/J517 Turbomachinery (3 cr)
Introduction to the basic principles of modern turbomachinery. Emphasis is placed on steam, gas (combustion), wind and hydraulic turbines. Applications of the principles of fluid mechanics, thermodynamics and aerodynamics to the design and analysis of turbines and compressors are incorporated. Additional technical research report and presentation reqd for grad cr. Recommended Preparation: ENGR 320, ENGR 335. Cooperative: open to WSU degree-seeking students (517 only).

ME J464/J564 Robotics: Kinematics, Dynamics, and Control (3 cr)
Mathematical analysis applied to spatial robotics including: Rigid body motion using screw theory, forward and inverse kinematics, analyses of forces and velocities using the manipulator Jacobian, serial and parallel chains, robot dynamics and simulation, nonlinear control and adaptive control, and Lyapunov stability theory. Additional projects/assignments required for graduate credit. Recommended Preparation: CS 120.
Prereq: MATH 310, MATH 330, and ME 313 or Equivalent, ME 330

ME 481 Control Systems (3 cr)
Same as ECE 470. Analysis and design of feedback control systems using frequency and time domain methods, and computer-aided design tools. Cooperative: open to WSU degree-seeking students.
Prereq: MATH 330
Prereq for Electrical Engineering and Computer Engineering majors**:** ECE 350
Prereq for Mechanical Engineering majors**:** ME 313

ME 525 Advanced Heat Transfer (3 cr)
Study of major chemical and physical principles affecting properties of solid state engineering materials. Topics include bonding, carrier statistics, band-gap engineering, optical and transport properties, novel materials systems, characterization, magnetism, and comprehensive introduction to physics of solid state devices. Cooperative: open to WSU degree-seeking students.
Prereq: Permission

ME 539 Advanced Mechanics of Materials (3 cr)
Same as CE 510 and MSE 539. Limitations of results of elementary mechanics of materials, complex situations of loading and structural geometry, applications to design of machines and structure, introduction to elasticity. Cooperative: open to WSU degree-seeking students.

Prereq: ME 341 or CE 342

ME 541 Mechanical Engineering Analysis (3 cr)
Mathematical modeling and solutions to mechanical engineering problems; analytical solutions to linear heat and mass diffusion, waves and vibrations; introduction to approximate techniques.
Cooperative: open to WSU degree-seeking students.
Prereq: MATH 330 & MATH 310 or Equivalent

3. Make the following curricular changes to the **Mechanical Engineering Major** (B.S.M.E.):

To advance to upper-division courses, a student majoring in mechanical engineering must earn certification: the student may accumulate no more than three grades of D or F in the mathematics, science or engineering courses used to satisfy certification requirements. ~~Included in this number are multiple repeats of a single course or single repeats in multiple courses and courses transferred from other institutions.~~Included in this number are courses transferred from other institutions, multiple repeats of a single course, and single repeats in multiple courses.

In addition, students must also earn at least five grades of 'B' or better in the following courses: CHEM 111, COMM 101, ENGL 102, ENGR 210, ENGR 220, ENGR 240, ENGR 350, MATH 170, MATH 175, MATH 275, MATH 310, ~~MATH 330,~~ ME 123, ME 223, ME 301, MSE 201, PHYS 211, and PHYS 212. A grade of P (pass) in any of these courses is considered as a C grade in satisfying this certification requirement.

To graduate in this program, a student ~~cannot~~may accumulate no more than five grades of D or F in the mathematics, science, or engineering courses used to satisfy graduation requirements. Included in this number are multiple repeats of a single course or single repeats in multiple courses and courses transferred from other institutions.

Required course work includes the university requirements (see regulation J-3), completion of the Fundamentals of Engineering (FE) examination and:

CE 411	Engineering Fundamentals	1 cr
CHEM 111	Principles of Chemistry I	4 cr
COMM 101	Fundamntls Public Speaking	2 cr
ENGL 317	Technical Writing	3 cr
ENGR 210	Engineering Statics	3 cr
ENGR 220	Engineering Dynamics	3 cr
ENGR 240	Introduction to Electrical Circuits	3 cr
ENGR 335	Engineering Fluid Mechanics	3 cr
ENGR 350	Engineering Mechanics of Materials	3 cr
MSE 201	Elements of Materials Science	3 cr
MATH 170	Analytic Geometry and Calculus I	4 cr
MATH 175	Analytic Geometry and Calculus II	4 cr
MATH 275	Analytic Geometry and Calculus III	3 cr
MATH 310	Ordinary Differential Equations	3 cr
MATH 330	Linear Algebra	3 cr

ME 123	Introduction to Mechanical Design	3 cr
ME 223	Mechanical Design Analysis	3 cr
ME 301	Computer Aided Design Methods	3 cr
ME 313	Dynamic Modeling of Engineering Systems	3 cr
ME 322	Mechanical Engineering Thermodynamics	3 cr
ME 325	Machine Component Design I	3 cr
ME 330	Experimental Methods for Engineers	3 cr
ME 341	Intermediate Mechanics of Materials	3 cr
ME 345	Heat Transfer	3 cr
ME 424	Mechanical Systems Design I	3 cr
ME 426	Mechanical Systems Design II	3 cr
ME 430	Senior Lab	3 cr
ME 435	Thermal Energy Systems Design	3 cr
PHIL 103	Ethics	3 cr
PHYS 211	Engineering Physics I	3 cr
PHYS 211L	Laboratory Physics I	1 cr
PHYS 212	Engineering Physics II	3 cr
PHYS 212L	Laboratory Physics II	1 cr

One from the following (3-4 cr):

ECON 201	Principles of Macroeconomics	3 cr
ECON 202	Principles of Microeconomics	3 cr
ECON 272	Foundations of Economic Analysis	4 cr

Technical Elective requirements for Mechanical Engineering (15 cr):
Fifteen credits of technical electives are required from the list below. The breakdown of credits will be as follows: ~~nine~~six credits must be an ME upper division course, three credits must be an upper division Math, Statistics or Physics course, the remaining ~~three~~six credits may be any course listed below:

BUS 414	Entrepreneurship	3 cr
BUS 456/ STAT 456	Quality Management	3 cr
ENGR 360	Engineering Economy	2 cr
MATH 371/ PHYS 371	Mathematical Physics	3 cr
MATH 420	Complex Variables	3 cr
MATH 428/ ENGR 428/ PHYS 428	Numerical Methods	3 cr
MATH 432	Numerical Linear Algebra	3 cr
MATH 437	Mathematical Biology	3 cr
MATH 451/ STAT 451	Probability Theory	3 cr
MATH 452/ STAT 452	Mathematical Statistics	3 cr
MATH 453/ STAT 453	Stochastic Models	3 cr

MATH 471	Introduction to Analysis I	3 cr
MATH 472	Introduction to Analysis II	3 cr
MATH 480	Partial Differential Equations	3 cr
ME 401	Engineering Team Projects	2-3 cr
ME 404	Special Topics	1-16 cr
ME 410	Principles of Lean Manufacturing	3 cr
ME 412	Gas Dynamics	3 cr
ME 413	Engineering Acoustics	3 cr
	OR	
ME 513/ ECE 579	Engineering Acoustics	3 cr
ME 414	HVAC Systems	3 cr
	OR	
ME 514	HVAC Systems	3 cr
ME 417	Turbomachinery	3 cr
	OR	
ME 517	Turbomachinery	3 cr
ME 420	Fluid Dynamics	3 cr
	OR	
ME 520/ CE 520	Fluid Dynamics	3 cr
ME 421	Advanced Computer Aided Design	3 cr
ME 422	Applied Thermodynamics	3 cr
ME 423	Human Factors and Ergonomics in Product Design	3 cr
ME 425	Machine Component Design II	3 cr
ME 433	Combustion Engine Systems	3 cr
ME 444	Air Conditioning Engineering	3 cr
ME 450	Computational Fluid Dynamics	3 cr
	OR	
ME 550	Computational Fluid Dynamics	3 cr
ME 451	Experimental Methods in Fluid Dynamics	3 cr
	OR	
ME 551/ CE 550	Experimental Methods in Fluid Dynamics	3 cr
ME 452	TechVentures: High Technology Entrepreneurship	3 cr
	OR	
ME 552	TechVentures: High Technology Entrepreneurship	3 cr
ME 461	Fatigue and Fracture Mechanics	3 cr

ME 464	Robotics: Kinematics, Dynamics, and Control	3 cr
	OR	
ME 564	Robotics: Kinematics, Dynamics, and Control	3 cr
ME 472	Mechanical Vibrations	3 cr
ME 481/ ECE 470	Control Systems	3 cr
ME 490	Solid Modeling, Stimulation and Manufacturing Capstone	3 cr
ME 519/ CE 519	Fluid Transients	3 cr
ME 521	Design Synthesis with Solid Modeling	3 cr
ME 525	Advanced Heat Transfer	3 cr
ME 529	Combustion and Air Pollution	3 cr
ME 539/ CE 510/ MSE 539	Advanced Mechanics of Materials	3 cr
ME 540	Continuum Mechanics	3 cr
ME 541	Mechanical Engineering Analysis	3 cr
ME 544	Conduction Heat Transfer	3 cr
ME 546	Convective Heat Transfer	3 cr
ME 547	Thermal Radiation Processes	3 cr
ME 548	Elasticity	3 cr
ME 549/ CE 546	Finite Element Analysis	3 cr
ME 571/ ARCH 571	Building Performance Simulation for Integrated Design	3 cr
ME 578/ CS 578/ ECE 578	Neural Network Design	3 cr
ME 580/ ECE 572	Linear System Theory	3 cr
ME 583/ CE 541	Reliability of Engineering Systems	3 cr
PHYS 351	Introductory Quantum Mechanics I	3 cr
PHYS 305	Modern Physics	3 cr
PHYS 411	Physical Instrumentation I	4 cr
PHYS 425	Relativity	3 cr
	OR	
PHYS 525	Relativity	3 cr
PHYS 428/ ENGR 428/ MATH 428	Numerical Methods	3 cr
	OR	
PHYS 528	Computational Physics	3 cr

PHYS 443	Optics	3 cr
	OR	
PHYS 543	Optics	3 cr
PHYS 444	Quantum Optics	3 cr
	OR	
PHYS 544	Quantum Optics	3 cr
PHYS 464/ MSE 464	Materials Physics and Engineering	3 cr
PHYS 465	Nuclear and Particle Physics	3 cr
	OR	
PHYS 565	Particle and Nuclear Physics	3 cr
PHYS 484	Astrophysics	3 cr
	OR	
PHYS 584	Astrophysics	3 cr
STAT 301	Probability and Statistics	3 cr
STAT 431	Statistical Analysis	3 cr
STAT 446/ BUS 446	Six Sigma Innovation	3
	Any Approved 400/500 Level Course in another Engineering Discipline	

A maximum of ~~3~~6 credits of the following may be used:

ME 307	Group Mentoring I	1 cr
ME 308	Group Mentoring II	1 cr
ME 401	Engineering Team Projects	2-3 cr
ME 407	Group Mentoring III	1 cr

Courses to total 128 credits for this degree, not counting ENGL 101**,** MATH 143**, and other courses that might be required to remove deficiencies.**

CHEMICAL AND MATERIALS ENGINEERING

1. Add the following course:

MSE 585 Nuclear Fuel Cycles (3 cr)
Same as NE 585. Processes to support the existing LWR fuel cycle. Alternative fuel cycles including U-233, Pu239 and mixed oxide fuels, and advanced reactor concepts. Recycling and recovery of nuclear materials, with emphasis on traditional fast reactor recycle.
Prereq: Permission

2. Change the following courses:

MSE 511 Nuclear Degradation Mechanisms (3 cr)
Same as NE 511. Topics include various degradation mechanisms as applicable to nuclear structural components, including corrosion, creep, radiation damage etc.
Prereq: Graduate standing or Permission

MSE 512 Nuclear Components Inspection (3 cr)
Same as NE 512. This course will cover various non-destructive testing techniques to evaluate the environmental degradation of the nuclear structural components. Remnant life estimation of structural components exposed to fatigue, creep and stress corrosion cracking service conditions will be discussed.
Prereq: Graduate standing or Permission

MSE 550 Nuclear Reactor Fuels (3 cr)
Same as NE 551. Selection of materials and design of nuclear fuels, light water reactor fuels, metal and oxide dispersed fuels, high temperature ceramic fuels.
Prereq: Permission

NUCLEAR ENGINEERING

1. Add the following courses:

NE 511 Nuclear Degradation Mechanisms (3 cr)
See MSE 511.

NE 512 Nuclear Components Inspection (3 cr)
See MSE 512.

NE 514 Nuclear Safety (3 cr)
See TM 514.

NE 516 Nuclear Rules and Regulations (3 cr)
See TM 516.

NE 524 Heat Exchanger Design (3 cr)
This course will cover advanced heat exchanger design and apply that knowledge to the design of the following heat exchangers: tube-in-tube heat exchanger, air cooler, compact heat exchanger, feedwater heater and condenser.
Prereq: Permission

NE 529 Risk Assessment (3 cr)
See TM 529.

NE 551 Nuclear Reactor Fuels.
See MSE 550.

2. Reactivate and change the following dormant course:

NE ~~R~~585 Nuclear Fuel Cycles (3 cr)
See MSE 585.~~Processes to support the existing LWR fuel cycle. Alternative fuel cycles including U-233, Pu 239 and mixed oxide fuels, and advanced reactor concepts. Recycling and recovery of nuclear materials, with emphasis on traditional fast reactor recycle.~~
~~**Prereq:** Permission~~

3. Change the following courses:

NE R575 Advanced Nuclear Power Engineering and Capstone (3 cr)
Present and advanced nuclear power plant descriptions and analysis. Engineering aspects of converting nuclear fission energy to useful work. Group project design.
Prereq: Permission

TECHNOLOGY MANAGEMENT

1. Add the following course:

TM 482 Project Engineering (3 cr)
See CE 482.

2. Change the following courses:

TM 514 Nuclear Safety (3 cr)
Same as NE 514. An in-depth technical study of safety issues within the nuclear fuel cycle and within various reactor types. Evaluation methods, system disturbances, safety criteria, containment, NRC licensing, and codes for safety analysis will be presented. Case studies of reactor accidents and corrective measures included.
Prereq: Permission

TM 516 Nuclear Rules and Regulations (3 cr)
Same as NE 516. An in-depth examination of nuclear regulatory agencies; major nuclear legislation; current radiation protection standards and organizational responsibility for their implementation.
Prereq: Permission

TM 529 Risk Assessment (3 cr)
Same as NE 529. In-depth evaluation and analysis techniques used to determine the risk of industrial, process, nuclear, and aviation industries; fault tree analysis; human reliability analysis; failure mode and effect analysis.

COLLEGE OF SCIENCE

BIOLOGICAL SCIENCES

1. Add the following courses:

BIOL J426/J526 Systems Biology (3 cr)
Two lec per wk. (Fall only, alt/yrs). Systems Biology will use quantitative approaches including theory and computation to understand the complex function that emerges from physiological systems. Topics will include transcriptional networks and their common motifs, robustness in chemotaxis and development, noise and variability, evolution of modularity, and optimality in metabolism. Cooperative: open to WSU degree-seeking students.
Prereq: BIOL 115 and MATH 170 or permission of instructor

BIOL 526 Systems Biology (3 cr)
See BIOL J426/J526.

2. Drop the following course:

BIOL 101 Perspectives in Biology (1 cr)
Open only to majors. Intro to the disciplines in the fields of biology; current research topics.

MATHEMATICS

1. Add the following course:

MATH 529 Numerical Methods (3 cr)
See Phys 528.

MTHE 409 Algebraic and Functional Reasoning (3 cr)
Examines the understandings that are foundational to advanced algebraic concepts, and how grade 5-10 students develop these ideas. Topics include strategies for solving equations and systems, covariational reasoning, properties of linear, quadratic, exponential, and trigonometric functions.

MTHE 410 Proof and Viable Argumentation (3 cr)
Develops viable argumentation as it can be found in grades 5-10 as a means of learning content, deepening understanding, and determining what is true and what is false mathematically. Topics include the language of argumentation, argument types, reasoning types, the distinction between proofs and viable arguments. Emphasizes how different argument types can contribute to student learning and increasing student discourse.

2. Change the following course:

MATH 395 Analysis of Algorithms (3 cr)

Same as CS 395. Measures of efficiency; standard methods and examples in the design, implementation, and analysis of algorithms. (Spring only)
Prereq: Math 175 and CS 121

STATISTICAL SCIENCE

1. Add the following course:

STAT 517 Statistical Learning and Predictive Modeling (3 cr)
A comprehensive overview of statistical learning and predictive modeling techniques to analyze large data sets in science, social science, and other data-rich fields including, for example, biology, business, and engineering. Topics include regression, classification, resampling methods, model selection and regularization, tree-based methods, support vector machines, clustering, and text mining. The implementation of the methods will be in R, and Python as needed. Basic experience with computer programming is assumed.
Prereq: STAT 431

2. Make the following curricular changes to the **Major in Statistical Science** (M.S.):

Students seeking admission to the MS program in Statistical Science should have completed at least two semesters in college calculus comparable to MATH 170 and MATH 175, and two classes in applied statistics including STAT 431 or a comparable course. Familiarity with programming is expected, and familiarity with numerical or statistical computing environments is desirable. Students are not required to have an undergraduate degree in statistics.

Candidates must fulfill the requirements of the College of Graduate Studies and of the Department of Statistical Science. See the College of Graduate Studies section for the applicable general requirements for M.S. degree.

An individual graduate program is tailored for the student, but all students must complete a basic core requirement of 24 credits and either i) a thesis (STAT 500), ii) an internship report (STAT 598), or iii) a consulting option or course (6 credits of STAT 597). Credits from Stat 431 will not count toward the degree.

UNIVERSITY COMMITTEE ON GENERAL EDUCATION

1. Add the following courses:

CORS 234 The Science of Engineering and Technology in the Modern World (3 cr)
An introduction and focus on how science and technology affect peace, security, community, democracy, environmental sustainability and human values. The class will help prepare future citizens to respond knowledgeably and reflectively to the most important scientific and technological challenges of the contemporary world. This course offers ways of integrating

knowledge in areas that are impossible to grasp through any single discipline; examples include Cybersecurity studies, Environmental studies, Globalization, Nuclear science, Robotics and Manufacturing in today's world and Sustainability studies. This course will enable students to form more robust understandings of the nature of scientific and technological change, the relationship of culture and science, and the limits of rational analytic methods in characterizing complex engineering problems, as well as the benefits and risks of the advances in science and technology.

CORS 235 As the World Burns: Fire on Earth (3 cr)
Fire is a fundamental element on the Earth's surface, and has been present for millennia. Anthropologists have established that human mastery of fire for cooking was one of the key moments in evolution when humans separated themselves from all other species and accelerated evolution towards modern civilization. Today, fire is a dominant force shaping the landscape on six continents, and is a major natural hazard in the western US, and particularly in the Northwest. It is both a major natural hazard and a critical ecological process, making the way we manage it and fight it highly controversial. The goal of this course is to explore the science of fire through the lens of how humans relate to it: through use of fire as a tool and fear of fire as one of the most destructive forces on Earth. Students will examine basic assumptions and views of fire through the scientific method to improve their understanding of ecology, evolution, physical Earth processes and natural hazards.