

CALIFORNIA STATE UNIVERSITY, BAKERSFIELD
ACADEMIC SENATE

AAC

Name Change for the B.S. In Engineering Sciences Degree

RES 212231

RESOLVED: That the name of the Bachelor of Science in Engineering Sciences degree be changed to Bachelor of Science in Engineering.

RATIONALE: The new name would more accurately convey the content of the program to students and employers and bring the program name into alignment with the majority of other universities across the country offering similar ABET-accredited programs.

ATTACHMENTS: Engineering Name Change Rationale, Other Supporting Documentation

Approved by the Senate April 28, 2022

Sent to the President May 6, 2022

Approved by the President May 12, 2022

Distribution List:

President

Provost

AVP AA and Dean Academic Operations

Dean NSME

Department Chair Computer and Electrical Engineering and Computer Science



CSU Bakersfield

School of Natural Sciences, Mathematics, and Engineering

Department of Physics and Engineering

Mail Stop: 64 SCI
9001 Stockdale Highway
Bakersfield, California 93311-1022

(661) 654-2664
(661) 654-2693 FAX
www.csub.edu/nsme

MEMORANDUM

Date: November 10th, 2021

To: NSME Curriculum Committee

From: Luis Cabrales, Chair, Department of Physics and Engineering

Todd McBride

Apr 6, 2022

Subject: Name change of the BS in Engineering Sciences

Approval:

The change of name has been approved by the Industrial Advisory Board for the engineering programs on 10/1/2020 and by the faculty of the Department of Physics and Engineering on 02/19/21.

Proposed Changes:

The Department of Physics and Engineering at California State University, Bakersfield, proposes that the degree currently titled “Bachelor of Science in Engineering Sciences” be changed to “Bachelor of Science in Engineering.” The proposed change in title would be accompanied by a change of the CIP and CSU Program Codes from 14.1301 and 09012 (Engineering Science) to 14.0101 and 09011 (Engineering), respectively. The change in degree title and program codes will have no impact on the ABET accreditation of the program or the program curriculum.

Resource Implications: None.

Curriculum Implications: None

Rationale: The primary reasons for the proposed name change and the accompanying code changes are 1. to reduce confusion among potential students and employers about the nature of the program and the degree and 2. to conform with the more common naming convention used by other broad-based engineering programs in the U.S. The proposed name change is in accordance to the Engineering Sciences (BS) Memorandum of Understanding (MOU) signed (Sep 22, 2021) between the Department of Physics and Engineering, the Office of the Dean of the School of Natural Sciences, Mathematics and Engineering, and the Office of the Provost resulting from the 2019 Program Review conducted during 2018-2019.

See attached documents for the full explanation of the rationale.



DOWNLOAD THIS FORM AND DO A "SAVE AS" COPY (and save in [designated] folder) BEFORE FILLING OUT THE FORM
CLICK ON THE GRAY AREA BEFORE TYPING IN A SECTION

CHANGES TO DEGREE FORM

Form Number

PROPOSAL ACTION (Select One)

EFFECTIVE CATALOG YEAR: FALL 2022

- PROGRAM REVISION, PROGRAM CANCELLATION, PROGRAM PLACED IN MORATORIUM, ADD CONCENTRATION, ADD EMPHASIS, ADD OPTION, ADD MINOR

PROGRAM OR SCHOOL & DEPARTMENT

School/Program: NSME, Engineering Sciences
Department: Physics and Engineering
Proposed by: Department of Physics and Engineering

DEGREE INFORMATION (MAJOR, CONCENTRATION/EMPHASIS/OPTION/MINOR)

Degree Title: B.S. in Engineering Sciences

REVISIONS TO CURRENT DEGREE DESCRIPTION AND REQUIREMENTS

Degree Description (Insert Degree Description from Current University Catalog; Use Strikethrough and Underline MS Word Actions To Delete Text Or Add/Revise Details):

See attached catalog document.

ADDING AN OPTION, CONCENTRATION OR SPECIAL EMPHASIS (ATTACH APPROPRIATE DOCUMENTS):

Per EO 1071, before any option, concentration, or special emphasis (or similar subprogram) approved under this delegation, can be implemented, the campus shall obtain a Chancellor's Office confirmation of compliance with CSU policy and applicable law. Campus notifications shall be submitted to the Department of Academic Programs and Faculty Development (degrees@calstate.edu). The following information must be submitted:

- The exact title of the new subprogram and the complete degree designation and title of the major degree program housing the new subprogram (e.g., Bachelor of Science in Biology with a Concentration in Biochemistry);
A list of courses and required units constituting that new subprogram;
Total units required to complete the entire degree, including the combination of subprogram and major program;

- The complete list of courses and required units constituting the major degree program as approved by the Chancellor’s Office;
- A 4-year major-and-subprogram roadmap for freshmen and a 2-year major-and-subprogram roadmap for transfer students;
- The CSU degree program code (formerly called “HEGIS”) that students use to apply to the major degree program;
- The campus-proposed CSU degree program code to be used to report enrollments in the concentration (may be the same as the degree code);
- A detailed cost-recovery budget for self-support subprograms to be offered within state-support major degree programs; and
- Documentation of all campus-required curricular approvals.

ADDING A MINOR

Program Description and Minor Requirements:

RATIONALE FOR DEGREE PROPOSAL *(required)*:

Provide Rationale for Degree Proposal:

See attached document.

IMPACT OF DEGREE PROPOSAL ON OTHER PROGRAMS OR DEPARTMENTS

What Is the Impact of This Degree Proposal on Course Offerings from Other Department(S) Or Programs?

Please Include Supporting Emails with This Proposal:

None

IMPACT OF DEGREE PROPOSAL ON COURSE(S)

List All the New and Revised Courses Required for This Degree Proposal (If Applicable):

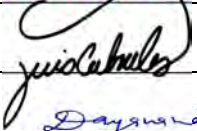
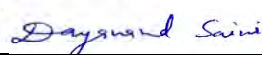

None

[Attach/Submit All the Course Proposal Forms Together with This Form for Curricular Review and Approval](#)

NEXT STEPS

- **Attach Course Proposal Form(s) to This Proposal (If Applicable)**
- **Attach Appropriate Documents if Adding an Option, Concentration or Special Emphasis**
- **Attach Revised Academic Roadmap**
- **Submit to Department/Program Curriculum Committee for Review & Approval**
- **Department Submits to School/Program Curriculum Committee for Review & Approval**
- **School/Program Curriculum Committee Submits Related Forms to GECCo (If Applicable)**
- **Chancellor’s Office (CO) Notification for Implementation of Option, Concentration or Special Emphasis**
- **If No Additional Approvals Are Required, School/Program Curriculum Committee Submits to Academic Operations After Final Approvals Have Been Recorded. [See Annual Catalog & Curriculum Deadlines Dates](#)**

SCHOOL/PROGRAM COMMITTEE & OTHER APPROVALS:

Department Chair/Program Director: Luis Cabrales 	Date: 11/10/21
School/Program Curriculum Committee Chair: Dayanand Saini 	Date: 11/18/2021
Dean of School: Todd McBride 	Date: Apr 6, 2022
Director of GE:	Date:
CO Notification for Implementation of Option, Concentration or Special Emphasis:	Date:
CO Confirmation of Compliance for Options, Concentration or Special Emphasis:	Date:
President's Approval for Minor:	Date:
WSCUC Approval:	Date:
Director of Academic Operations:	Date:

ACADEMIC OPERATIONS USE ONLY:

Effective Term:	Catalog Year:
Comments:	
CIP Code:	
HEGIS Code:	
Program Code:	
Plan Code:	
Sub-Plan Code:	
Catalog Updated:	
Updated Academic Requirements Page:	
Updated Academic Road Maps:	
Updated Program Plan Mapper:	
Admissions Office Notified:	



MEMORANDUM

DATE: April 6, 2022

TO: Dr. Aaron Hegde / Chair, Academic Senate

CC: Dr. John Tarjan / Chair, Academic Affairs Committee
Ms. Beth Bywaters / Administrative Analyst, Academic Senate
Dr. Luis Cabrales / Chair, Department of Physics and Engineering
Dr. Dayanand Saini / Chair, NSME Curriculum Committee
Dr. Todd McBride / Interim Dean, School of Natural Sciences, Mathematics, and Engineering
Ms. Lisa Zuzarte / Director, Academic Operations

FROM: Debra Jackson / AVP for Academic Affairs, Dean of Academic Programs

RE: Proposal for Revision of B.S. in Engineering Sciences

On behalf of the faculty of the Department of Physics and Engineering, I am submitting to the Academic Affairs Committee a proposal to revise the B.S. in Engineering Sciences (CIP 14.1301) to become a B.S. in Engineering (CIP 14.0101). This proposal was supported by the Industrial advisory board, the faculty in the Department of Physics and Engineering, the Natural Sciences, Mathematics, and Engineering Curriculum Committee, and the Interim Dean of the School of Natural Sciences, Mathematics, and Engineering.

Attachments:

Memo NSME Curriculum Committee Engineering - signed
CSUB_Engineering rationale_Edited copy 2
2021-2022_Engineering_catalog change name engineering
2021-2022_Engineering_catalog change name engineering clean version

Proposal

The Department of Physics and Engineering at California State University, Bakersfield, proposes that the degree currently titled “Bachelor of Science in Engineering Sciences” be changed to “Bachelor of Science in Engineering.” The proposed change in title would be accompanied by a change of the CIP and CSU Program Codes from 14.1301 and 09012 (Engineering Science) to 14.0101 and 09011 (Engineering), respectively. The change in degree title and program codes will have no impact on the ABET accreditation of the program or the program curriculum.

Background

The degree of B.S. in Engineering Sciences has been offered by the Department of Physics and Engineering since Fall 2012. It is a broad-based, general engineering degree that provides graduates with a technical foundation in engineering fundamentals and critical skills related to engineering practice. The program was developed to provide a flexible engineering program that would maximize the local employment opportunities for graduates. To this end, the program offers the following emphases relevant to local industries: 1. Biosystems and Agricultural Engineering, 2. Energy and Power Engineering, 3. Engineering Management, and 4. Petroleum Engineering. The original rationale for the name of Engineering Sciences was to underscore the broad-based nature of the program and to emphasize its foundation in the sciences. However, the name has confused the stakeholders (e.g., potential students and the future employers of the current students) whether it is an engineering program or a science-based program. In August 2018 (and retroactive to October 1, 2016), the program was granted accreditation from the Engineering Accreditation Commission of ABET under the Program Criteria of *Engineering, General Engineering, Engineering Physics, and Engineering Science*. However, there remains confusion among potential students and employers concerning the name of the degree.

In the Bachelor of Science in Engineering Sciences Self-Study and Program Plan completed in Feb 2019, the departmental faculty had reviewed the need to change the program’s name and decided to change the program’s name to Bachelor of Science in Engineering (B.S. in Engineering).

Rationale

The primary reasons for the proposed name change and the accompanying code changes are 1. to reduce confusion among potential students and employers about the nature of the program and the degree and 2. to conform with the more common naming convention used by other broad-based engineering programs in the U.S. There are currently 106 programs in the U.S. that have ABET accreditation under the Program Criteria of *Engineering, General Engineering, Engineering Physics, and Engineering Sciences*. Although there does not appear to be a general correlation between degree title and program curriculum among the accredited programs, the majority use the title of Engineering. Of the 106 accredited programs, 59 have the degree title of B.S. in Engineering, 18 have the title of B.S. in Engineering Physics, 14 have the title of B.S. in Engineering Science(s), and the rest have less common titles such as B.S. in General Engineering.

No other school in the CSU system currently offers a comparable accredited degree. CSU Fullerton offers a B.S. in Engineering degree that is not accredited but has similar core engineering requirements to the Engineering Sciences degree at CSU Bakersfield. Table 1 compares the degree requirements for the CSU Bakersfield program to that at CSU Fullerton. The table also shows the degree requirements for two other accredited engineering programs that offer a B.S. in Engineering. Harvey Mudd College (HMC) is a prestigious private engineering, science, and mathematics university located in Claremont, CA and Southern Utah University (SUU) is a public university in Cedar City, UT that has similar enrollment numbers to CSU Bakersfield.

The definition for the program's current CIP Code (14.1301) and its paired CSU Degree Program Code (090112) for Engineering Science is:

A program with a general focus on the general application of various combinations of mathematical and scientific principles to the analysis and evaluation of engineering problems, including applied research in human behavior, statistics, biology, chemistry, the earth and planetary sciences, atmospheric and meteorology, and computer applications.

While the above definition is broadly applicable to the Engineering Sciences program offered at CSU Bakersfield, the references to such topics as human behavior, earth and planetary science, and atmospheric and meteorology suggest a more general science-based program. The definition for the CIP and CSU Degree Program Codes for Engineering, 14.0101 and 09011, respectively, shown below is a more appropriate definition for the broad-based engineering program offered at CSU Bakersfield.

A program that generally prepares individuals to apply mathematical and scientific principles to solve a wide variety of practical problems in industry, social organization, public works, and commerce. Includes instruction in undifferentiated and individualized programs in engineering.

The change of name has been approved by the Industrial advisory board on 10/1/2020 and by the department on 02/19/21.

Table 1. Comparison of CSUB Engineering Sciences Curriculum with similar Engineering Curricula at CSUF, SUU, and HMC.

	CSUB Engineering Sciences	CSUF Engineering	SUU Engineering	HMC Engineering
ABET Accredited	Yes	No	Yes	Yes
Core Eng.	49	21	32	48.5
Cognates	33	33	25	39
UD Eng. Electives	13	39	29-30	9
GE + Other University Requirements	25	24	30-35	30
UD Writing Requirement	May be satisfied by exam or course	3	3	1.5
Total	120 Units	120 Units	120 - 122 Units	128 Units
Lower-Division Engineering Design	ENGR 1618 (2) ENGR 1628 (2)		ENGR 1000 (1) ENGR 1050 (1)	ENGR004 (4)
Basic Circuits	ENGR 2070 (4)	EGEE 203 (4)	ENGR 2250 (3) ENGR 2255 (1)	
Statics	ENGR 2110 (3)	EGCE 201 (3)	ENGR 2010 (3)	
Dynamics	ENGR 2120 (3)		ENGR 2030 (3)	
Materials	ENGR 2130 (3) ENGR 2140 (4)		ENGR 2140 (3) ENGR 2145 (1)	ENGR086 (3)
Eng. Graphics	ENGR 2350 (2)	EGME 102 (2)		
Digital Computation		EGGN/ EGME 205 (3)		
Project Management			ENGR 3030 (3)	
LD Eng. Systems				ENGR059 (3)
LD Eng. Electives				6 semester units
Total	23 Units	12 Units	16 Units	16 Units
Engineering Mathematics	ENGR 3300 (3) ENGR 3310 (3)			ENGR072 (1.5)
Engineering Economics and Professionalism		EGCE/EGCP/ EGEE/EGME 401 (3)		
UD Eng. Systems				ENGR101 (3) ENGR102 (3)
Dynamics		EGCE 302 (3)		
Thermodynamics	ENGR 3110 (4)	EGME 304 (3)	ENGR 3000 (3)	ENGR082 (3)
Fluid Mechanics	ENGR 3120 (4)		ENGR 3050 (3) ENGR 3055 (1)	ENGR083 (3)
Heat Transfer	ENGR 4110 (4)			
Upper-Division Engineering Design	ENGR 4120 (4) ENGR 4900 (2) ENGR 4910 (2)		ENGR 4025 (3) ENGR 4085 (3)	ENGR111 (3) ENGR112 (3) ENGR113 (3)
UD Eng. Seminar				ENGR122 (0.5) ENGR124 (0.5)
Analog Electronics				ENGR084 (3)
Digital Electronics				ENGR085 (3)
Experimental Eng.				ENGR080 (3)
Total	26 Units	9 Units	16 Units	32.5 Units

Biosystems and Agriculture Engineering Emphasis	ENGR 3400 (3) ENGR 3410(4) ENGR 4410 (3) ENGR 4420 (3)			
Energy and Power Engineering Emphasis	ENGR 4610 (3) ENGR 4620 (3) ECE 3370 (4) ECE 4380 (3)	A Sequence of Courses in Civil, Computer, Electrical and/or Mechanical Eng.	A Sequence of Courses in Civil or Electrical Eng.	Three Upper-Division Engineering Technical Electives (9 units)
Engineering Management Emphasis	ENGR 4200 (3) ENGR 4220 (3) ENGR 4240 (3) ENGR 4260 (3) ENGR (1)			
Petroleum Engineering Emphasis	ENGR 4520 (3) ENGR 4530 (4) ENGR 4540 (4) ENGR (2)			
Total	13 Units			
Chemistry	CHEM 1000 (2) CHEM 1001 (2) CHEM 1600 (3)	CHEM 123/ CHEM 120A (3)	CHEM 1210 (4) CHEM 1215 (1)	CHEM023A (3) CHEM023B (1.5) CHEM024 (1)
Physics	PHYS 2210 (4) PHYS 2220 (4)	PHYS 225 (4) PHYS 226 (4) PHYS 227 (4)	PHYS 2220 (4) PHYS 2225 (1)	PHYS023 (1.5) PHYS024 (3) PHYS050 (1) PHYS051 (3)
Calculus	MATH 2310 or 2510 (4) MATH 2320 or 2520 (4)	MATH 150A (4) MATH 150B (4) MATH 250A (4)	MATH 1220 (4)	MATH030B/ MATH030G (1.5) MATH060 (1.5)
Computer Science				CSCI005 (3)
Linear Algebra and Differential Equations		MATH 250B (4)	MATH 2250 (4)	MATH040 (1.5) MATH045 (1.5) MATH065 (1.5)
Engineering Analysis		EGCE/EGEE/ EGGN/EGME 308 (3)		
Probability and Statistics			MATH 1040 (4)	MATH035(1.5)
Biology				BIOL023 (1) BIOL052 (3)
Humanities, Social Sciences, and the Arts				HSA010 (3)
Ethics	PHIL 3318 (3)			
Physical Education				3 semester units
Lower-Division Engineering Elective				ENGR079 (3)
Major-Level Math/Science Electives	BIOL/PHYS/GEOL/ CHEM/MATH (7)			
Total	33 Units	33 Units	25 Units	39 Units

Department of Physics and Engineering

School of Natural Sciences, Mathematics, and Engineering

Department Chair: Luis Cabrales Arriaga

Program Office: Science Building III, 308

Telephone: (661) 654-2664

Email: engineering@csub.edu

Website: www.csub.edu/engineering

Faculty: T. Acharya, L. Cabrales Arriaga, A. Dzyubenko, G. Dzyubenko, V. Gasparyan, P. Guo, S. Hong, J. Lewis, Y. Li, Z. Liu, T. Moore, K. Prasai, K. Salehpoor, D. Saini

Emeriti Faculty: T. Meyer (Physics and Computer Science), R. Negrini (Physics and Geology), J. Talamantes (Physics and Engineering)

Program Description

Engineering is a broad-based general engineering degree program accredited by the Engineering Accreditation Commission of ABET, www.abet.org. As such, it provides the graduate flexibility, breadth of technical knowledge, and communication skills so important in today's rapidly changing multidisciplinary and multicultural work environment. The student may opt for a BS in Engineering with an Emphasis on Biosystems and Agricultural Engineering, Energy and Power Engineering, Engineering Management, or Petroleum Engineering by the appropriate choice of required cognate and elective courses.

The Engineering program provides a curriculum and course of training that prepares the student not only for today's challenges, but also for future ones in a fast-paced, global, and diverse society. The program emphasizes the fundamentals of engineering and modern methods, processes and technologies, and also gives the students the tools to learn by themselves and to pursue life-long learning. Furthermore, the program and the faculty strive to ensure that graduates also attain a global understanding of the environmental, ethical and societal impacts of the technologies they help develop.

The program offers opportunities for team-based design projects in collaboration with local industries and public institutions, thus preparing students for careers in for-profit and non-profit organizations, or to further their education in graduate school. Faculty members of the Department of Physics and Engineering will be pleased to advise any students who may wish to pursue this major. For student learning objectives and more information, visit our website at www.csub.edu/engineering.

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Requirements for the Bachelor of Science Degree in Engineering, accredited by the Engineering Accreditation Commission of ABET, www.abet.org

Requirements	Units
Total Units Required to Graduate	120 units
Major Requirements	95
Lower Division	23
Upper Division	26
Upper Division Emphasis Electives	13
Cognates	33
General Education Requirements	25 units
First-Year Seminar	0*
LD Area A Foundational Skills	6*
LD Area B Natural Sciences	0*
LD Area C Arts and Humanities	6
LD Area D Social and Behavioral Sciences	0*
LD Area F Ethnic Studies	3
American Institutions	6
SELF	0*
Junior Year Diversity Requirement	3
UD Thematic Area C	0*
UD Thematic Area D	0*
Capstone	1
GWAR	0*
Additional Units	0

***General Education Modifications (GEMS)**

ENGR 1618 and 1628 satisfy the FYS requirement for entering Freshmen

The required Physics courses (PHYS 2210, 2220) or CHEM 1000, 1001 will satisfy Areas B1 and B3

Areas A3 and B2 are satisfied by completion of the major in Engineering

Any of the required calculus courses (MATH 2310, 2320, or MATH 2510, 2520) will satisfy Area B4

The SELF requirement is met by completing a LD Area B, C, or D course with a SELF component

UD Thematic Area D is satisfied by completion of the Engineering major

PHIL 3318 must be taken and will satisfy UD Thematic Area C

The GWAR may be satisfied by exam

Requirements for the Major in Engineering (95 units)

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Lower Division (23 units)

ENGR 1618(2), 1628(2), 2070(4), 2110(3), 2120(3), 2130(3), 2140(4), 2350(2)

Upper Division required (26 units)

ENGR 3300(3), 3310(3), 3110(4), 3120(4), 4110(4), 4120(4), 4900(2), 4910(2)

Upper Division Electives (select 13 units)

ENGR 3070, 3400, 3410, 4200, 4220, 4240, 4260, 4410, 4420, 4520, 4530, 4540, 4610 4620, 4700, 4800

ENGR 4700 and 4800 are offered at the discretion of faculty on an as-needed basis.

A maximum of 4 units of ENGR 4700 and 3 units of ENGR 4800 can be used for upper division elective credit towards major requirements.

Cognates Requirements (18 units)

CHEM 1000(3), 1001(2), 1600(2), PHIL 3318(3), PHYS 2210(4), 2220(4)

Calculus Cognates (8 units)

MATH 2310(4), 2320(4) or 2510(4), 2520(4)

Additional Cognates: Mathematics and Science (select at least 7 units)

BIOL 2010, 2110 or 2120 , CHEM 1100, 2200, 2300 or 2500 , GEOL 2010, 2040, 3000, 3010, 3070, 4010, 4050, 4060 4150 or 4771, PHYS 2230, 3010, 3510, 3520, 4700, or 4800 , or MATH 2330, 2531, 2532, 2533, 2540, 2610, 3000, 3200, 3210, 3300, 4500.

Requirements for the Bachelor of Science Degree in Engineering with Biosystems and Agricultural Engineering Emphasis (95 units)

Lower Division (23 units)

ENGR 1618, 1628, 2070, 2110, 2120, 2130, 2140, 2350

Upper Division (26 units)

ENGR 3300, 3310, 3110, 3120, 4110, 4120, 4900, 4910

Upper Division Emphasis Electives (13 units)

ENGR 3400(3), 3410(4), 4410(3), 4420(3)

Emphasis Cognates (4 units)

BIOL 2010(4) or 2110(4) or 2120(4)

Cognate Requirements (18 units)

CHEM 1000, 1001, 1600, PHIL 3318, PHYS 2210, 2220

Calculus Cognates (8 units)

MATH 2310, 2320 or 2510, 2520

Additional Cognates: Mathematics and Science (select at least 3 units)

BIOL 2010, 2110 or 2120 , CHEM 1100, 2200, 2300 or 2500 , GEOL 2010, 2040, 3000, 3010, 3070, 4010, 4050, 4060 4150 or 4771, PHYS 2230, 3010, 3510, 3520, 4700, or 4800 , or MATH 2330, 2531, 2532, 2533, 2540, 2610, 3000, 3200, 3210, 3300, 4500. Although not required for the emphasis, students are strongly advised to take ENGR 4260. In addition, students pursuing this emphasis are encouraged to undertake a design project related to biosystems and agricultural engineering, when available, in ENGR 4900 and 4910.

Requirements for the Major in Engineering with Energy and Power Engineering Emphasis (95 units)

Lower Division (23 units)

ENGR 1618, 1628, 2070, 2110, 2120, 2130, 2140, 2350

Upper Division (26 units)

ENGR 3300, 3310, 3110, 3120, 4110, 4120, 4900, 4910

Upper Division Emphasis Electives (13 units)

ENGR 4610(3), 4620(3), ECE 3370(4), 4380(3)

Cognates Requirements (18 units)

CHEM 1000, 1001, 1600, PHIL 3318, PHYS 2210, 2220

Calculus Cognates (8 units)

MATH 2310, 2320 or 2510, 2520

Additional Cognates: Mathematics and Science (select at least 7 units)

BIOL 2010, 2110 or 2120 , CHEM 1100, 2200, 2300 or 2500 , GEOL 2010, 2040, 3000, 3010, 3070, 4010, 4050, 4060 4150 or 4771, PHYS 2230, 3010, 3510, 3520, 4700, or 4800 , or MATH 2330, 2531, 2532, 2533, 2540, 2610, 3000, 3200, 3210, 3300, 4500. Students pursuing this emphasis are encouraged to undertake a design project related to energy and power engineering, when available, in ENGR 4900 and 4910.

Requirements for the Major in Engineering with Engineering Management Emphasis (95 units)

Lower Division (23 units)

ENGR 1618, 1628, 2070, 2110, 2120, 2130, 2140, 2350

Upper Division (26 units)

ENGR 3300, 3310, 3110, 3120, 4110, 4120, 4900, 4910

Upper Division Emphasis Electives (13 units)

ENGR 4200(3), 4220(3), 4240(3), 4260(3)

Select at least one unit from: ENGR 3070, 3400, 3410, 4410, 4420, 4520, 4530, 4540, 4610, 4620, 4700, 4800

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*ENGR 4700 and 4800 are offered at the discretion of faculty on an as-needed basis.
A maximum of 4 units of ENGR 4700 and 3 units of ENGR 4800 can be used for upper division elective credit towards major requirements.*

Cognates Requirements (18units)

CHEM 1000, 1001, 1600, PHIL 3318, PHYS 2210, 2220

Calculus Cognates (8 units)

MATH 2310, 2320 or 2510, 2520

Additional Cognates: Mathematics and Science (select at least 7 units)

BIOL 2010, 2110 or 2120 , CHEM 1100, 2200, 2300 or 2500 , GEOL 2010, 2040, 3000, 3010, 3070, 4010, 4050, 4060 4150 or 4771, PHYS 2230, 3010, 3510, 3520, 4700, or 4800 , or MATH 2330, 2531, 2532, 2533, 2540, 2610, 3000, 3200, 3210, 3300, 4500.

Requirements for the Major in Engineering with Petroleum Engineering Emphasis (95 units)

Lower Division (23 units)

ENGR 1618, 1628, 2070, 2110, 2120, 2130, 2140, 2350

Upper Division (26 units)

ENGR 3300, 3310, 3110, 3120, 4110, 4120, 4900, 4910

Upper Division Emphasis Electives (13 units)

ENGR 4520(3), 4530(4), 4540(4)

Select at least two units from: ENGR 3070, 3400, 3410, 4200, 4220, 4240, 4260, 4410, 4420, 4610, 4620, 4700, 4800

ENGR 4700 and 4800 are offered at the discretion of faculty on an as-needed basis.

A maximum of 4 units of ENGR 4700 and 3 units of ENGR 4800 can be used for upper division elective credit towards major requirements.

Emphasis Cognates (4 units)

GEOL 4060

Cognates Requirements (18 units)

CHEM 1000, 1001, 1600, PHIL 3318, PHYS 2210, 2220

Calculus Cognates (8 units)

MATH 2310, 2320 or 2510, 2520

Additional Cognates: Mathematics and Science (select at least 3 units)

BIOL 2010, 2110 or 2120 , CHEM 1100, 2200, 2300 or 2500 , GEOL 2010, 2040, 3000, 3010, 3070, 4010, 4050, 4060 4150 or 4771, PHYS 2230, 3010, 3510, 3520, 4700, or 4800 , or MATH 2330, 2531, 2532, 2533, 2540, 2610, 3000, 3200, 3210, 3300, 4500. Although not required for the emphasis, students are strongly advised to take ENGR 4260. In addition, students pursuing

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this emphasis are encouraged to undertake a design project related to petroleum engineering, when available, in ENGR 4900 and 4910.