Kansas Board of Regents
Academic Affairs
PROPOSAL FOR A NEW DEGREE PROGRAM

Format. Font: Times New Roman, 11-point; Margins: top/bottom -- 1 inch; left/right -- .08 inch
Should a scroll bar appear, you have exceeded your limit. Only what appears in the designated space will be posted.

Please check one: ☑ Baccalaureate Program ☐ Master's Program ☐ Doctoral Program

A. General Information

1. Institution: ☐ ESU ☐ FHSU ☑ K-State ☐ KU ☐ KUMC ☐ PSU ☐ WSU
   (check one)

2. Program Identification:

   Program Title: Environmental Engineering

   Degree to be Offered: Bachelor of Science in Environmental Engineering

   Responsible Department or Unit: BAE and CE

   CIP Code: 14.1401 Proposed Implementation Date: Fall 2019

   Total Number of Semester Credit Hours for the Degree: 126

B. Justification and Program Demand

1. Justification:
   In the space below, provide a brief description of the program and indicate why this program is important to your institution and to the state of Kansas. (Please refer to **Format** directions above.)

Environmental engineers use engineering and other scientific principles to solve complex environmental problems. They may be involved in recycling efforts, waste management, public health initiatives, water quality management, and pollution control work. As environmental problems continue to develop, environmental engineers are increasingly called upon to create innovative solutions to sustain our planet.

This program would provide an undergraduate degree for students interested in protecting the environment and developing sustainable engineered solutions for water, air, and soil resources. The program will prepare students to apply mathematical and scientific principles to the design, development, and operational evaluation of systems for controlling contained living environments; and for monitoring and controlling factors in the external natural environment, including pollution control, waste and hazardous material disposal, health and safety protection, conservation, life support, and requirements for protection of special materials and related work environments.

Environmental engineers may work in a wide variety of fields, leading to multiple employment opportunities in government, consulting and industry. Due to the breadth of this field, environmental engineers may be called to work on any number of projects impacting the environment from air pollution control to wastewater treatment to ecosystem restoration in the state of Kansas and around the globe.

2. Demand: Select one of the two options for indicating student demand:

Option A. Survey of Student Interest

Number of surveys administered: …… _____
Number of completed surveys returned: ……. _____
Percentage of students interested in program: … _____

Option B. Market Analysis

Attach a one-page analysis that reflects trends, changing student demographics, curricular growth patterns, etc., to forecast student demand for this program. (*Please note formatting information and provide citations for sources.*)

3. Demand: Projected Enrollment for the Initial Three Years of the Program

Indicate how many students/credit hours are projected in the charts below.

Year	Headcount		Sem Credit Hrs	
	Full-Time	Part-Time	Full-Time	Part-Time
Implementation	24		720	
Year 2	30		900	
Year 3	40		1200	

4. Demand: Employment

In the space below, provide a brief narrative of projected job openings for graduates of this program. This may include such sources as the Kansas labor market information from the KS Department of Labor and/or the US Department of Labor. (*Please note formatting information and provide citations for sources.*)

The U.S. Department of Labor, Bureau of Labor Statistics reported 53,800 environmental engineering jobs in 2016 (https://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm). As of May 2017, the average annual salary for environmental engineers was $91,180 (median salary $86,800; 10% $52,160) (https://www.bls.gov/oes/current/oes172081.htm#ind) . The BLS reports a projected growth of 8% (4,500 jobs) between 2016 and 2026. Expected growth is related to state and local governments' concerns regarding water availability and quality, both issues of significance in Kansas. Environmental engineering graduates would play a significant role in assisting Kansas realize the Kansas Water Vision (https://kwo.ks.gov/water-vision-water-plan/water-vision).

C. Curriculum

1. Admission/Requirements:

   In the space below, describe the admission standards for the program.

The College of Engineering has a selective admissions process for all new students. Prospective students must first be admitted to Kansas State University. Students who are admitted to Kansas State University and who indicated a College of Engineering degree program as their primary program choice are then evaluated by the College of Engineering Office of Student Services for entry to one of the colleges degree programs. The basic criteria requires that prospective students must have an ACT score of 21 (or an SAT of 980) plus a high school GPA of 3.00 or higher in order to be admitted into the College of Engineering. Students who have been admitted to K-State and who do not meet this criteria are advised to enroll in "Open Option" through the College of Arts and Sciences and to follow a suggested pre-engineering pathway.

2. Courses:

   Attach a one-page semester-by-semester degree plan.

D. Core Faculty

1. Inventory

   Provide an inventory of core faculty directly involved with program. For each faculty member, provide the following information.
   If applicable, place an * next to the faculty member who will direct this program.
   Rank refers to *Adjunct, Instructor, Assistant Professor, Associate Professor, Professor*, etc.
   FTE refers to *Full Time Equivalent* to this program (1.0 = full time)

Faculty Name	Rank	Highest Degree	Tenure Track Y/N	Academic Area of Specialization	FTE to Proposed Program
Hutchinson, Stacy L.*	Professor	PhD	Y	Ecological Engr/Water Res Engr	0.5
Im, Jeongdae	Asst. Professor	PhD	Y	Environmental Biotechnology	0.1
Maghirang, Ronaldo	Professor	PhD	Y	Air Quality	0.125
Marsten, Landon	Asst. Professor	PhD	Y	Water Resources	0.125
Moore, Trisha	Asst. Professor	PhD	Y	Ecological Engineering	0.125
Parameswaran, Prathap	Asst. Professor	PhD	Y	Environmental Engineering	0.125
Sheshulov, Aleksey	Assoc. Professor	PhD	Y	Water Resources Engineering	0.125
Wilken, Lisa	Assoc. Professor	PhD	Y	Biological Engineering	0.375
Brokesh, Edwin	Instructor	MBA	N	Agricultural Engineering	0.25

2. Identify the number of graduate assistantships that will be assigned to the program: 0

E. Expenditures and Revenue:

Please complete the information below and provide explanations* as clearly-labeled attachments.

	List Amounts in Dollars		
I. EXPENDITURES	First FY	Second FY	Third FY
Personnel – Reassigned or Existing Positions* *(*Provide written explanations as necessary and attach to this document)*			
Faculty	$ 60,771	$ 130,202	$ 162,045
Administrators *(other than instruction time)*	$ 28,399	$ 28,967	$ 29,535
Graduate Assistants	$ 19,500	$ 39,780	$ 60,840
Support Staff for Administration (*e.g., secretarial*)	$ 12,000	$ 12,240	$ 12,480
Fringe Benefits *(total for all groups)*	$ 33,184	$ 58,077	$ 72,847
Other Personnel Costs			
Total Existing Personnel Costs – Reassigned or Existing	$ 153,854	$ 269,266	$ 337,747
Personnel – New Positions* *(*Provide written explanations as necessary and attach to this document)*			
Faculty			
Administrators *(other than instruction time)*			
Graduate Assistants			
Support Staff for Administration (*e.g., secretarial*)			
Fringe Benefits *(total for all groups)*			
Other Personnel Costs			
Total New Personnel Costs -- New Positions	$ 0	$ 0	$ 0
Start-up Costs – One-Time Expenses* *(*Provide written explanations as necessary and attach to this document)*			
Library/learning resources			
Equipment/Technology			
Physical Facilities: Construction or Renovation	$ 400,000		
Other			
Total Start-up Costs	$ 400,000	$ 0	$ 0
Operating Costs – Recurring Expenses* *(*Provide written explanations as necessary and attach to this document)*			
Supplies/Expenses	$ 7,200	$ 9,180	$ 12,480
Library/learning resources			
Equipment/Technology	$ 14,000	$ 18,360	$ 24,960
Travel			
Other			
Total Operating Costs	$ 21,200	$ 27,540	$ 37,440
GRAND TOTAL COSTS	$ 575,054	$ 296,806	$ 375,187

	List Amounts in Dollars			
II. FUNDING SOURCES* *(projected as appropriate) (*Provide written explanations as necessary and attach to this document)*	Current	First FY (New)	Second FY (New)	Third FY (New)
Tuition / State Funds		$ 450,000	$ 573,750	$ 780,000
Student Fees		$ 133,920	$ 170,748	$ 232128
Other Sources **				
GRAND TOTAL FUNDING	$ 0	$ 583,920	$ 744,498	$ 1,012,128
Projected Surplus/Deficit (Grand Total FUNDING *minus* Grand Total Costs)		$ 8,866	$ 447,692	$ 636,941

***Other Sources:*

As appropriate for each source, please describe the length of financial commitment and note the expiration date. (Examples could include federal, state, and/or private grants, etc.)

Institutional Contact Person:

Name: _____ E-mail: _____

Date of Proposal Submission: _____

Submit completed form to Max Fridell, mfridell@ksbor.org.

Print or Save

Please submit the following with this proposal:

B.2: One-Page Market Analysis (if you chose *Option B*)
C.2: One-Page Semester-By-Semester Degree Plan
E: Expenditures and Funding Sources (as needed)

Environmental Engineering Bachelor of Science Curriculum

Freshmen Year					
Fall Semester				credits	
	MATH	220	Analytic Geometry and Calculus I	4	
	CHM	210	Chemistry I	4	
	ECON	110	Principles of Macroeconomics	3	
	ENVE	101	Introduction to Environmental Engineering	1	
	ENGL	100	Expository Writing I	3	
			Total Credits for semester		15
Spring Semester					
	BIOL	198	Principles of Biology	4	
	CHM	230	Chemistry II	4	
	COMM	105	Public Speaking 1A	2	
	MATH	221	Analytic Geometry and Calculus II	4	
			H&SS Elective	3	
			Total Credits for semester		17
Sophomore Year					
Fall Semester					
	CHM	350	General Organic Chemistry	3	
	MATH	222	Analytic Geometry and Calculus III	4	
	PHYS	213	Engineering Physics I	5	
			Earth Science Elective	3	
			Total Credits for semester		15
Spring Semester					
	BAE	345	Biological Materials	2	
	BAE	346	Biological Materials Lab	1	
	CE	530	Statics and Dynamics	3	
	IMSE	530	Engineering Economics Analysis	2	
	MATH	240	Elementary Differential Equations	4	
	PHYS	214	Engineering Physics II	5	
			Total Credits for semester		17
Junior Year					
Fall Semester					
	STAT	510	Introduction to Probability and Statistics	3	
	BAE	445	Biological Engineering Fundamentals	3	
OR	CE	563	Environmental Engineering Fundamentals		
	CHE		Chem Process Analysis		
	ME	513	Thermodynamics	3	
OR	CHE	520			
	ME	571	Fluid Mechanics	3	
OR	CHE	530	Transport Phenomena I		
	CE	202	Civil Engineering Graphics OR	3	
OR	GEOG	508	Geographic Information Systems I		
			Total Credits for semester		15
Spring Semester					
	ENVE	331	Professional Practice in Environmental Engineering	1	
	BAE	645	BioEnvironmental Reaction Engineering	3	

OR	CHE	550	Chemical Reaction Engineering		
	EECE	519	Electrical Circuits and Control	4	
	BAE	663	Environmental and Ecological Risk Assessment	3	
	BAE	560	Hydrology for biological systems OR	3	
OR	CE	550	Water Resources Engineering		
			Biological Science Elective	3	
			Total Credits for semester		17
Senior Year					
Fall Semester					
	ENVE	536	Senior Design	3	
	BAE	643	Life Cycle Assessment	3	
	ENGL	415	Written Communication for Engineers	3	
	BAE	660	Hydraulic Transport in Biological Systems OR	3	
OR	CE	552	Hydraulic Engineering		
			Technical Elective	3	
			Total Credits for semester		15
Spring Semester					
			Restricted Environmental Engineering Elective	3	
			Restricted Environmental Engineering Elective	3	
			Technical Elective	3	
			Technical Elective	3	
			H&SS Elective	3	
			Total Credits for semester		15
			Total Credits for Degree Program		126

Market Analysis

Environmental engineers use engineering and other scientific principles to solve complex environmental problems. They may be involved in recycling efforts, waste management, public health initiatives, water quality management, and pollution control work. As environmental problems continue to develop, environmental engineers are increasingly called upon to create innovative solutions to sustain our planet.

The College of Engineering commissioned a market analysis by Hanover Research (2016) to assess the potential of an environmental engineering program. Key finding from the report include:

- **Trends indicate sufficient demand to support a Bachelor of Science in environmental engineering program at Kansas State University**. Strong degree completions, favorable occupational projections, and low competitor saturation in the region point to a promising environment for such a degree. If KSU developed an environmental engineering program, the offering would face no in-state competition in the near future.
- **Multiple indicators suggest growing student demand for bachelor's degree programs in environmental engineering, despite a low volume of regional completions.** In the last five years, national demand for environmental engineering degrees increased over 16 percent at an annualized rate, and regional demand by 18 percent at an annualized rate. The volume of regional conferrals is low overall (165 in 2015), however, due to the limited number of available programs. No environmental engineering bachelor's programs are currently offered in Kansas.
- **Environmental engineering graduates have promising job prospects over the next decade, nationally, regionally, and in Kansas.** Occupational projections forecast 6 percent employment growth for environmental engineering professions nationally and nearly 15 percent in Kansas. Furthermore, environmental issues facing the region are likely to contribute to greater demand for environmental engineers.
- **Regional competitive saturation for bachelor's degree programs in environmental engineering is low.** Thirteen institutions offer a bachelor's program; of these, only seven reported more than 10 conferrals in 2015. Most regional programs are located in Colorado or Texas.
- **KSU may be able to capitalize on existing engineering associate's programs in the region as potential articulation pathways.** Regional institutions reported a total of 950 completions in 2015 in engineering associate's degrees. These degrees cover the basic engineering requirements that an environmental engineering bachelor's credential could build upon.
- **Several partnership opportunities with local schools, organizations, and programs exist for KSU to build community recognition for the proposed environmental engineering program.** Programs such as Project Lead the Way, the National Science Foundation, and Kansas City STEM Alliance present opportunities to interact with local K-12 students, families, and teachers to increase interest in environmental engineering and create potential pathways to enrollment at K-State.

Environmental Engineering
Assessment of Student Learning

Student Learning Outcome 1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Assessment Measure(s):

a) Ability to employ mass and/or energy balance to solve an engineering problem. This will be assessed using homework from fundamental biological and environmental engineering courses (BAE 445 and CE 563).
b) Ability to represent a system with a mathematical or physical model. This will be assessed using homework from fundamental biological and environmental engineering courses (BAE 445 and CE 563).
c) Ability to apply advanced biology/chemistry to solve an engineering problem. This will be assessed using homework from BAE 645 Bioenvironmental Reactor Engineering.

Assessment Timeline:
The performance criteria will be assessed each time the course is taught. SLO overall assessment will be based on an annual combination of all data.

Student Learning Outcome 2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

Assessment Measure(s):

a) Understanding of the engineering design process (objectives, constraints, criteria, synthesis, analysis, construction, testing, evaluation). This will be assessed using coursework from ENVE 331 – Professional Practice in Environmental Engineering.
b) Ability to evaluate a system, component or process. This will be assessed using coursework from BAE 643 – Life Cycle Analysis and the final project report from ENVE 536 – Senior Design.
c) Ability to design a system, component, or process for an environmental system. This will be assessed using coursework from BAE 643 – Life Cycle Analysis and the final project report from ENVE 536 – Senior Design.
d) Ability to interpret and explain results of analysis/problem solutions. This will be assessed using homework from BAE 645 Bioenvironmental Reactor Engineering and BAE 663 – Environmental and Ecological Risk Assessment.

Assessment Timeline:
The performance criteria will be assessed each time the course is taught. SLO overall assessment will be based on an annual combination of all data.

Student Learning Outcome 3: An ability to communicate effectively with a range of audiences

Assessment Measure(s):

a) Ability to communicate information, ideas, and concepts effectively in writing. This will be assessed the final written project report from ENVE 536 – Senior Design.
b) Ability to communicate orally information, ideas, and concepts effectively. This will be assessed the final oral presentation from ENVE 536 – Senior Design.

c) Whenever possible, final project presentations in ENVE 536 are given during the semi-annual Industry Advisory Board meetings so students can get feedback from non-academic engineers.

Assessment Timeline:
The performance criteria will be assessed each time the course is taught. SLO overall assessment will be based on an annual combination of all data.

Student Learning Outcome 4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

Assessment Measure(s):

a) Ability to explain how different technical or engineering solutions to similar problems may be adopted in different parts of the world. This will be assessed using coursework from ENVE 331 – Professional Practice in Environmental Engineering.
b) Ability to critique engineering solutions to a problem, identifying possible negative global or societal consequences and recommending ways to minimize them. This will be assessed using coursework from ENVE 331 – Professional Practice in Environmental Engineering and BAE 643 – Life Cycle Analysis.
c) Knowledge of current and emerging technological issues. This will be assessed using coursework from ENVE 331 – Professional Practice in Environmental Engineering and BAE 643 – Life Cycle Analysis.
d) Understanding of how current trends and social concerns may affect implementation of engineering solutions. This will be assessed using coursework from ENVE 331 – Professional Practice in Environmental Engineering and BAE 663 – Environmental and Ecological Risk Assessment.

Assessment Timeline:
The performance criteria will be assessed each time the course is taught. SLO overall assessment will be based on an annual combination of all data.

Student Learning Outcome 5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Assessment Measure(s):

a) Understanding of team dynamics and stages of team development. This will be assessed using coursework from ENVE 331 – Professional Practice in Environmental Engineering.
b) Understanding of roles of the various team members. This will be assessed using coursework from ENVE 331 – Professional Practice in Environmental Engineering.
c) Ability to work together on team-based projects, working cooperatively with others, encouraging active participation of others, dealing productively with conflict. This will be the final project report from ENVE 536 – Senior Design.

Assessment Timeline:

The performance criteria will be assessed each time the course is taught. SLO overall assessment will be based on an annual combination of all data.

Student Learning Outcome 6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Assessment Measure(s):

a) Ability to design an experiment to test a hypothesis or solve an engineering problem. This will be assessed using coursework from BAE 346 - Properties of Biological Materials Lab.
b) Ability to conduct/perform an experiment to test a hypothesis. This will be assessed using coursework from BAE 346 - Properties of Biological Materials Lab.
c) Ability to analyze and interpret experimental data using statistical, mathematical and/or computational methods. This will be assessed using homework from fundamental biological and environmental engineering courses (BAE 445 and CE 563).

Assessment Timeline:
The performance criteria will be assessed each time the course is taught. SLO overall assessment will be based on an annual combination of all data.

Student Learning Outcome 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Assessment Measure(s):

a) Ability to identify and take advantage of learning opportunities (e.g., internship, study abroad, minors, honors program, design teams). This will be assessed using the Senior Exit Interview conducted each semester.
b) Ability to acquire and critique new information (e.g., internet search engines, refereed publications, etc.) This will be the final project report from ENVE 536 – Senior Design.
c) Recognition of the need for and importance of knowledge gained from activities outside formal education. This will be the final project report from ENVE 536 – Senior Design.
d) Membership and participation in professional or other organizations. This will be assessed using the Senior Exit Interview conducted each semester.

Assessment Timeline:
The performance criteria will be assessed each time the course is taught. SLO overall assessment will be based on an annual combination of all data.

Plan for annual faculty review of outcome data:
Assessment data will be submitted by the responsible faculty to the program assessment committee prior to the beginning of classes the following semester. In January, the assessment committee will be to discuss any immediate concerns. Overall program assessment will be completed using materials collected throughout the academic year.

		Student Learning Outcomes and Performance Criteria	Assessment Method	Frequency Direct/Indirect
1		an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics		
	a	Ability to employ mass and/or energy balance to solve an engineering problem.	Coursework - BAE 445, CE 563	Annually Direct
	b	Ability to represent a system with a mathematical or physical model.	Coursework - BAE 445, CE 563	Annually Direct
	c	Ability to apply advanced biology/chemistry to solve an engineering problem.	Coursework - BAE 645	Annually Direct
2		an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors		
	a	Understanding of the engineering design process (objectives, constraints, criteria, synthesis, analysis, construction, testing, evaluation).	Coursework - EE 331	Annually Direct
	b	Ability to evaluate a system, component or process.	Coursework - BAE 643; Project - EE 536	Annually Direct
	c	Ability to design a system, component, or process for an environmental system.	Coursework - BAE 643; Project - EE 536	Annually Direct
	d	Ability to interpret and explain results of analysis/problem solutions.	Coursework - BAE 645, BAE 663	Annually Direct
3		an ability to communicate effectively with a range of audiences		
	a	Ability to communicate information, ideas, and concepts effectively in writing.	Project - EE 536	Annually Direct
	b	Ability to communicate orally information, ideas, and concepts effectively.	Project - EE 536	Annually Direct
	c	Whenever possible, final project presentations in EE 536 are given during the semi-annual Industry Advisory Board meetings so students can get feedback from non-academic engineers.	Industry Advisory Board	Indirect
4		an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts		
	a	Ability to explain how different technical or engineering solutions to similar problems may be adopted in different parts of the world.	Coursework - EE 331	Annually Direct
	b	Ability to critique engineering solutions to a problem, identifying possible negative global or societal consequences and recommending ways to minimize them.	Coursework - EE 331, BAE 643	Annually Direct
	c	Knowledge of current and emerging technological issues.	Coursework - EE 331, BAE 643	Annually Direct
	d	Understanding of how current trends and social concerns may affect implementation of engineering solutions.	Coursework - EE 331, BAE 663	Annually Direct
5		an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives		
	a	Understanding of team dynamics and stages of team development.	Couresework - EE 331	Annually Direct
	b	Understanding of roles of the various team members.	Coursework - EE 331	Annually Direct
	c	Ability to work together on team-based projects, working cooperatively with others, encouraging active participation of others, dealing productively with conflict.	Project - EE 536	Annually Direct
6		an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions		
	a	Ability to design an experiment to test a hypothesis or solve an engineering problem.	Coursework - BAE 346	Annually Direct
	b	Ability to conduct/perform an experiment to test a hypothesis.	Coursework - BAE 346	Annually Direct
	c	Ability to analyze and interpret experimental data using statistical, mathematical and/or computational methods.	Coursework - BAE 445, CE 563	Annually Direct
7		an ability to acquire and apply new knowledge as needed, using appropriate learning strategies		
	a	Ability to identify and take advantage of learning opportunities (e.g., internship, study abroad, minors, honors program, design teams).	Senior Exit Interview	Annually Indirect
	b	Ability to acquire and critique new information (e.g., internet search engines, refereed publications, etc.)	Project - EE 536	Annually Direct
	c	Recognition of the need for and importance of knowledge gained from activities outside formal education.	Project - EE 536	Annually Direct
	d	Membership and participation in professional or other organizations.	Senior Exit Interview	Annually Indirect