



**SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS**

New Graduate Degree Program

UNIVERSITY:	SDSU
PROPOSED GRADUATE PROGRAM:	Mechanical Engineering
EXISTING OR NEW MAJOR(S):	Existing
DEGREE:	Doctor of Philosophy (Ph.D.)
EXISTING OR NEW DEGREE(S):	Existing
INTENDED DATE OF IMPLEMENTATION:	2020-2021 Academic Year
PROPOSED CIP CODE:	14.1901
SPECIALIZATIONS:¹	N/A
IS A SPECIALIZATION REQUIRED (Y/N):	No
DATE OF INTENT TO PLAN APPROVAL:	Waived
UNIVERSITY DEPARTMENT:	Mechanical Engineering
UNIVERSITY DIVISION:	Graduate School

University Approval

To the Board of Regents and the Executive Director: I certify that I have read this proposal, that I believe it to be accurate, and that it has been evaluated and approved as provided by university policy.

President of the University

10/29/2019

Date

1. What is the nature/purpose of the proposed program?

South Dakota State University (SDSU) requests authorization to offer a Ph.D. program in Mechanical Engineering. The program will leverage collaborative opportunities with the Ph.D. in Mechanical Engineering at the South Dakota School of Mines and Technology (SDSM&T). Collaboration will strengthen programs at both institutions and will enhance the effective use of faculty and facilities resources within the BOR system. The primary purposes of the proposed program are:

1. to provide a mechanism to improve the success of faculty research efforts and to provide expanded graduate educational opportunities for South Dakota students interested in pursuing academic or research-focused careers in mechanical engineering;
2. to improve the prospects for recruiting highly-qualified and productive faculty members;
3. to enhance the chances for success of SDSU M.E. faculty in competing for research funding;

¹ If the proposed new program includes specific specializations within it, complete and submit a New Specialization Form for each proposed specialization and attach it to this form. Since specializations appear on transcripts, they require Board of Regents approval.

4. to support the development of new technologies and provide an appropriate vehicle to drive innovation and entrepreneurship through the Research Park at South Dakota State University;
5. to assist South Dakota's continued economic growth and diversification by preparing graduates to work in:
 - advanced manufacturing, including research and development of innovative techniques for manufacturing processes, automation, and process control
 - development of biomedical processes, equipment and systems in support of the growing high-impact regional medical industry
 - engineering of systems used in production agriculture, including technology for precision agriculture
 - renewable energy and bio-resource conversion technologies.

SDSU currently offers a Ph.D. in Agricultural, Biosystems, and Mechanical Engineering (ABME). This degree configuration has not proven attractive to qualified students with mechanical engineering backgrounds who are interested in research-based careers. This hinders recruiting of mechanical engineering students. The backgrounds of students currently enrolled in the program are a hodge-podge of unrelated disciplines, indicating that it appeals mainly to students with food or agriculture focus, or to those who want to earn a Ph.D. but for various reasons do not have other good options. It is not serving the needs of the mechanical engineering graduate program. Potential students who want to pursue a mechanical engineering graduate degree believe that it will be an unnecessary obstacle to seeking employment after graduation.

Infrastructure and expertise exist at SDSU to support research and innovation in the fields mentioned above. SDSM&T possesses complementary infrastructure and expertise. Sharing of courses would make a wider variety of subjects available to students. Collaboration between the programs would enhance the effectiveness of system resources and strengthen our competitive advantage in applying for external research funding. More and larger research proposals could be developed. Faculty and students would have expanded opportunities to participate in research. The combined resources and existing industry connections of the two institutions would also improve opportunities to attract industry R&D support and could increase the number of new companies springing from research discoveries.

2. How does the proposed program relate to the university's mission and strategic plan, and to the current Board of Regents Strategic Plan 2014-2020?²

The proposed program is consistent with the statutory mission of South Dakota State University as provided in SDCL 13-58-1: *Designated as South Dakota's Land-grant University, South Dakota State University, formerly the State College of Agriculture and Mechanical Arts, located at Brookings, in Brookings County, shall be under the control of the Board of Regents and shall provide undergraduate and graduate programs of instruction in the liberal arts and sciences and professional education in agriculture, education, engineering, home economics, nursing and pharmacy, and other courses or programs as the Board of Regents may determine.*

² South Dakota statutes regarding university mission are located in SDCL 13-57 through 13-60; Board of Regents policies regarding university mission are located in Board Policies 1:10:1 through 1:10:6. The Strategic Plan 2014-2020 is available from https://www.sdbor.edu/the-board/agendaitems/Documents/2014/October/16_BOR1014.pdf.

Board Policy 1:10:2 South Dakota State University Mission Statement provides: *The legislature established South Dakota State University as the Comprehensive Land Grant University to meet the needs of the State and region by providing undergraduate and graduate programs of instruction in the liberal arts and sciences and professional education in agriculture, education, engineering, human sciences, nursing, pharmacy, and other courses or programs as the Board of Regents may determine (SDCL 13-58-1).*

The Board implemented SDCL 13-58-1 by authorizing South Dakota State University to serve students and clients through teaching, research, and extension activities. The University's primary goal is to provide undergraduate and graduate programs at the freshman through the doctoral levels. The University complements this goal by conducting nationally competitive strategic research and scholarly and creative activities. Furthermore, South Dakota State University facilitates the transference of knowledge through the Cooperative Extension Service with a presence in every county and through other entities, especially to serve the citizens of South Dakota.

South Dakota State University is unique within the South Dakota System of Higher Education because of its comprehensive land grant mission. The mission is implemented through integrated programs of instruction, the Cooperative Extension Service, the Agricultural Experiment Station, and numerous auxiliary and laboratory services.

The proposed program relates directly to SDSU's mission of providing academic programs through the doctoral level in engineering. SDSU offers other Ph.D. programs in science and engineering fields, including Ph.D.s in Civil Engineering, Electrical Engineering, and Computational Science and Statistics. The University has offered the B.S. degree in Mechanical Engineering since 1884 and the M.S. degree for many decades.

The program supports the Board of Regents' Strategic Plan 2014-2020 by specifically addressing the following points (Policy 1:21)³:

Vision

- 2.1. South Dakota's population will be more highly-educated.
- 2.2. South Dakotans will have increased access to continuing education opportunities needed to upgrade their credentials while remaining in the workforce.
- 2.4. The South Dakota economy will benefit from significant increases in university and associated research-derived commercialization activities.

Goals

- 3.1.1.1. Grow the number of undergraduate and graduate degrees awarded.
- 3.2.1.3. Continue to approve new graduate programs.
- 3.2.2.3. Encourage student engagement in research and service.
- 3.3.1.1. Increase grant and contract expenditures.
- 3.3.1.2. Increase the number of invention disclosures.
- 3.3.1.3. Increase the number of signed license agreements.
- 3.3.1.4. Increase the number of licenses signed with start-up companies.
- 3.3.1.5. Increase the number of graduates from STEM programs.
- 3.3.2.1. Support the universities' efforts to enhance research and development productivity through grants and contracts in key research sectors, recognizing the mission of each of the Regental universities.

³ <https://www.sdbor.edu/policy/Documents/1-21.pdf>

3.3.2.2. Expand educational opportunities in the areas of science, technology, engineering, and mathematics.

3.3.2.3. Contribute to the state’s workforce and economic development.

The proposed Ph.D. program would also be prepared to support state initiatives related to key industries:⁴

- advanced manufacturing
- bioscience
- value-added agriculture

The proposed program is consistent with ‘Imagine 2023: Aspire. Discover. Achieve. A Strategic Plan for South Dakota State University’⁵, including goals: [1] Achieve Excellence Through Transformative Education and [3] Foster Innovation and Increase Research, Scholarship, and Creative Activity. Ph.D. programs are indispensable to fostering and sustaining research activity.

3. Describe the workforce demand for graduates of the program, including national demand and demand within South Dakota. *Provide data and examples; data sources may include but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc.*

Mechanical engineers have been a vital and growing part of South Dakota’s technical workforce for decades. As the state continues to grow its economy in areas of science, technology, engineering and mathematics, the demand for post-baccalaureate engineers in the applications of mechanical engineering (biofuels, bio-processing, medical devices, renewable energy, value-added and advanced manufacturing) will continue to grow.

The SD Governor’s Office of Economic Development lists bioscience, advanced manufacturing, and value-added agriculture as three of the five “key industries” for the state.⁶ This Ph.D. program would support all three of these key industries.

Current statewide demand for Ph.D. graduates is primarily with research-oriented academic institutions and with research and development firms engaged in energy and value-added product development. Various state and federal agencies also employ Ph.D. graduates.

As the demand for high-technology solutions to problems in biosciences, manufacturing and value-added processing continues to grow, mechanical engineers with graduate degrees will be needed to conduct the research necessary to transform innovative concepts into economically viable devices and systems.

Data on hiring and employment projections for graduates of specific M.S. and Ph.D. programs is scant. Most of the information is reported by discipline, with B.S., M.S. and Ph.D. graduates aggregated in a single category. There is however good evidence that employers are increasingly seeking new employees with advanced degrees. The National Association of Colleges and Employers Job Outlook 2017 Spring Update⁷ reported that more than half of the employers surveyed planned to hire master’s graduates and that there was a

⁴ <https://sdreadytowork.com/key-industries/>

⁵ <https://www.sdstate.edu/imagine-2023-aspire-discover-achieve>

⁶ <https://sdreadytowork.com/key-industries/>

⁷ <https://www.naceweb.org/job-market/trends-and-predictions/job-outlook-the-degrees-and-majors-most-in-demand/>

significant jump in the percentage of respondents hiring graduates with doctoral degrees. The percentage of respondents planning to hire graduates with doctoral degrees went from 15.7 in 2016 to 25.8 in 2017. In the same survey, 75.9% of the respondents were hiring engineering graduates, with more than half of all new hires having engineering degrees.

At the national level, the U.S. Bureau of Labor Statistics projects growth of 4% in the number of mechanical engineering jobs over the period 2018-28.⁸ The U.S. BLS estimated 2018 employment in mechanical engineering positions at 312,900. According to the U.S. BLS, job prospects may be best for those with training in the latest software tools, particularly for computational design and simulation.⁹ Individuals with graduate degrees will be uniquely positioned to take advantage of those prospects.

The South Dakota Department of Labor projects a total increase in mechanical engineering employment of 17% over the 10-year period 2016-2026.¹⁰ This is nearly twice the projected national 10-year percentage increase. Nearly half of all mechanical engineers are employed in the manufacturing sector.¹¹ Besides South Dakota, the strongest regional demand for SDSU M.E. graduates is in the state of Minnesota. The Minnesota Department of Employment and Economic Development rates the current demand for mechanical engineers as “High” and estimates the expected 10-year openings (new plus replacement) at 5,255 in Minnesota.¹²

4. How will the proposed program benefit students?

The program will provide students with depth of knowledge that will allow them to investigate new applications and new concepts to advance the state of the art in the discipline. It will also provide them with practical training and experience in the scientific methods needed to conduct reliable experiments and to apply and properly validate engineering models of physical systems. Critical thinking and communication skills developed in the program will prepare students for leadership roles. Overall, the knowledge and skills gained will prepare them for life-long careers in highly desirable research and development positions.

5. Program Proposal Rationale:

A. If a new degree is proposed, what is the rationale¹³

This is not a new degree.

B. What is the rationale for the curriculum?

The proposed program at SDSU closely follows the SDSM&T program in order to facilitate an optimum level of collaboration between the institutions. The curriculum for

⁸ Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Mechanical Engineers, on the Internet at <https://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm> (visited *October 07, 2019*).

⁹ <https://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm#tab-6>

¹⁰ <https://www.southdakotaworks.org/vosnet/Default.aspx>, Labor Market Information Center, Virtual labor market data system, search: Mechanical Engineers

¹¹ <https://data.bls.gov/projections/nationalMatrix?queryParams=17-2141&ioType=o>

¹² <https://apps.deed.state.mn.us/lmi/cpt/Overview>

¹³ “New Degree” means new to the university. Thus if a campus has degree granting authority for a Ph.D. program and the request is for a new Ph.D. program, a new degree is not proposed.

the SDSM&T Ph.D. was originally modeled after the Ph.D. in M.E. program at the University of Minnesota, and this remains an appropriate model. It provides for a balance of coursework and dissertation credits and meets the objective of allowing for both flexibility of individual plans of study and ability to develop depth of expertise. The curriculum includes a core course that can be selected from that offered by either institution and allows for the student to select courses offered by either institution to complete the plan of study.

The proposed program will allow the institutions to share courses and faculty expertise. The collaboration will also expand access to experimental and laboratory resources by making these resources at each institution available to a wider group of students and researchers. This approach will make optimal use of the State's investments in the public university system. The curriculum provides maximum flexibility to accommodate the numerous and constantly evolving areas of specialty while also providing the ability to develop depth of expertise in a particular branch of application.

C. Demonstrate/provide evidence that the curriculum is consistent with current national standards. *Complete the tables below and explain any unusual aspects of the proposed curriculum?*

Leading graduate programs in mechanical engineering were reviewed in developing this proposal. The structure and content of the proposed program is very similar to that of these well-established programs. Specific programs consulted include:

- University of Minnesota, Ph.D. in Mechanical Engineering¹⁴
- Iowa State University, Ph.D. in Mechanical Engineering¹⁵
- Colorado State University, Ph.D. in Mechanical Engineering¹⁶

D. Summary of the degree program:

Ph.D. in Mechanical Engineering	Credit Hours	Percent
Required courses, all students	3	4.2%
Dissertation	36	50%
Electives**	33	45.8%
Total Required for the Degree Total	72*	100%

*Students may apply up to 24 credits of coursework and up to 6 research credits from a previous M.S. degree to the Ph.D. requirements, subject to approval by the student's graduate advisory committee. The 6 research credits transferred must be ME 798 or equivalent.

**All electives must be approved by the student's graduate advisory committee. Up to 12 credits of elective coursework can be taken from other disciplines.

Required Courses

Prefix	Number	Course Title	Credit Hours	New (yes, no)
ME	790	Seminar	2	No
GSR	601	Research Regulations Compliance	1	No

¹⁴ <https://onestop2.umn.edu/pcas/viewCatalogProgram.do?programID=7008>

¹⁵ <http://www.me.iastate.edu/graduate-program/degrees-and-programs/phd-degree/>

¹⁶ <https://www.engr.colostate.edu/me/ph-d/>

ME	898D	Dissertation	36	No
Subtotal			39	

Elective Courses

The following list of graduate level courses are offered at either SDSU or SDSM&T.

Prefix	Number	Course Title	Credit Hours	New (yes, no)
EM	522	Theory of Elasticity	3	No
EM	523	Theory of Plasticity	3	No
EM	624	Theory of Plates and Shells	3	No
EM	731	Advanced Fluid Mechanics	3	No
EM	741	Finite Element Analysis	3	No
ME	502	Gas Dynamics	3	No
ME	510	Principles of HVAC Engineering	3	No
ME	512	Internal Combustion Engines	3	No
ME	513	Turbomachinery	3	No
ME	514	Air Pollution Control	3	No
ME	516	Renewable Energy Systems	3	No
ME	517-517L	Computer-Aided Engineering	3	No
ME	518	Design of Thermal Systems	3	No
ME	528-528L	Appl Finite Element Analysis	3	No
ME	531	Aerodynamics	3	No
ME	532-532L	Experimental Stress Analysis	3	No
ME	533-533L	Non-Destructive Test/Evaluation	3	No
ME	537	Gas Dynamics I	3	No
ME	539-539L	HVAC Systems Design	3	No
ME	540	Computer-Aided Design	3	No
ME	542	Apps. Of Computational Fluid Dynamics	3	No
ME	544-544L	Mechanics of Viscoelastic Solids	3	No
ME	546	Biomedical Applications	3	No
ME	553-553L	Feedback Control Systems	3	No
ME	555-555L	Adv. App. In Computational Mechanics	3	No
ME	557	Intermediate Dynamics	3	No
ME	561	Analysis and Design of Industrial Systems	3	No
ME	612	Transport Phenomena: Momentum	3	No
ME	613	Transport Phenomena: Heat	3	No
ME	616	Computations Transport Phenomena	3	No
ME	618	Conduction Heat Transfer	3	No
ME	619	Convection Heat Transfer	3	No
ME	620	Radiation Heat Transfer	3	No
ME	623	Advanced Mechanical Vibrations	3	No
ME	625	Smart Structures	3	No
ME	673	Applied Engineering Analysis I	3	No
ME	680	Advanced Strength of Materials	3	No
ME	683	Advanced Mech System Control	3	No
ME	703	Thermo-Fluid Energy Systems	3	No
ME	711	Advanced Heat Transfer 1	3	No
ME	712	Convection Heat Transfer	3	No
ME	713	Advanced Solid Mechanics	3	No

Prefix	Number	Course Title	Credit Hours	New (yes, no)
ME	715	Advanced Composite Materials	3	No
ME	721	Viscous Flow I	3	No
ME	731	Advanced Analytical Methods	3	No
ME	735-735L	Modeling and Simulation	3	No
ME	736	Adv. Finite Element Methods	3	No
ME	739	Advanced Metallurgy	3	No
ME	741	Adv. Stress Analysis Mech. Design	3	No
ME	745	Advanced Machine Design	3	No
ME	760	Quality Control	3	No
ME	761	Operations Research	3	No
ME	763	Topics in Reliability Engr.	3	No
ME	765	Systems Analysis	3	No
ME	767	Decision Theory	3	No
ME	770	Continuum Mechanics	3	No
ME	773	Applied Engineering Analysis II	3	No
ME	781	Robotics	3	No
ME	791	Independent Study	1-9	No
ME	792	Topics	1-3	No

6. Student Outcomes and Demonstration of Individual Achievement

- A. What specific knowledge and competencies, including technology competencies, will all students demonstrate before graduation?** *The knowledge and competencies should be specific to the program and not routinely expected of all university graduates.*
Complete Appendix A – Outcomes using the system form. *Outcomes discussed below should be the same as those in Appendix A.*

Appendix A identifies the student outcomes which are intended to ensure that students are adequately prepared to enter employment in industry, government service or continue in an academic career track.

Through seminar, coursework and laboratory experiences graduates are expected to demonstrate the ability to:

1. Acquire and apply the knowledge and skills to make an original contribution to the mechanical engineering field.
2. Conduct independent research within a supportive framework.
3. Understand and critically evaluate the relevant engineering literature.
4. Communicate relevant engineering principles and theories by written, oral, and visual means.
5. Apply engineering principles and procedures to the recognition, interpretation, and understanding of prior and current knowledge in the field.
6. Exhibit an appropriate awareness of and commitment to the ethical conduct of research.

These skills will be developed through formal coursework, student seminar presentations within the program and at professional meetings, and the written dissertation.

B. Are national instruments (i.e., examinations) available to measure individual student achievement in this field? If so, list them.

None.

C. How will individual students demonstrate mastery? Describe the specific examinations and/or processes used, including any external measures.¹⁷ What are the consequences for students who do not demonstrate mastery?

Mastery will be demonstrated by assessing the outcomes identified in Appendix A and adherence to the existing policies of the SDSU Graduate School's Doctor of Philosophy Degree Requirements (refer to the 2019-2020 SDSU Graduate Catalog).¹⁸

Mastery of individual course content will be demonstrated, in part, through traditionally graded courses. Learning must also be demonstrated outside the traditional lecture/laboratory classroom. For example, admission into candidacy for the degree will be granted only upon successful completion of a comprehensive examination. These examinations are both written and oral ensuring the student has not only mastered the material but can communicate effectively in a variety of formats. To complete the degree, the student must present and defend their research, again, in both written and oral formats. The written and oral candidacy exams and the written and oral final examinations are overseen by the student's Graduate Advisory Committee. Completion of the seminar requirements, the final oral presentation of the dissertation, and the dissertation itself will be assessed using the Mechanical Engineering department's institutionally-approved doctoral program assessment rubrics. The outcomes of these assessments are reported as a part of the department's regular Academic Assessment and Evaluation reporting activities.

In accordance with SDSU Graduate School policy, students who fail to meet minimum performance standards on their first attempt are given a second chance to demonstrate mastery. The department as well as the Graduate School ensures the student has every opportunity for success. However, students who ultimately fail to demonstrate mastery of the content and skills necessary for admission to candidacy or fail to successfully defend their dissertation are given the option to complete a Master of Science degree. The Department offers the M.S. to accommodate these students. For these students, the academic rigor of completing a Master of Science degree is applied.

7. What instructional approaches and technologies will instructors use to teach courses in the program? *This refers to the instructional technologies and approaches used to teach courses and NOT the technology applications and approaches expected of students.*

Standard contemporary classroom lecture and laboratory technologies (including D2L) as well as Access Grid or the Digital Dakota Network (DDN) will be used.

¹⁷ What national examination, externally evaluated portfolio or student activity, etc., will verify that individuals have attained a high level of competence and identify those who need additional work?

¹⁸ <https://catalog.sdstate.edu/content.php?catoid=37&navoid=6018>

8. Did the University engage any developmental consultants to assist with the development of the curriculum?¹⁹ Did the University consult any professional or accrediting associations during the development of the curriculum? What were the contributions of the consultants and associations to the development of curriculum?

No developmental consultants were engaged in developing this proposal.

The curriculum was developed with reference to the existing curriculum at SDSM&T as well as those of the University of Minnesota, Iowa State University, and Colorado State University.

9. Are students enrolling in the program expected to be new to the university or redirected from other existing programs at the university? Complete the table below and explain the methodology used in developing the estimates (replace “XX” in the table with the appropriate year)? If question 12 includes a request for authorization for off-campus or distance delivery, add lines to the table for off-campus/distance students, credit hours, and graduates.

Three Ph.D. students who desire to complete a mechanical engineering degree are currently enrolled in the ABME Ph.D. at SDSU. These students will be redirected to the Ph.D. in Mechanical Engineering. Other students will be new to the University or will continue into the Ph.D. program after completing the M.S. in Mechanical Engineering at SDSU.

New student enrollments are initially expected to be two per year, with numbers stabilizing at around three per year by the third year of program existence. To estimate program output, data from the NSF NCSES report for four of SDSU’s peer institutions (New Mexico State University, North Dakota State University, the University of Idaho and the University of Wyoming) were collected. In addition, data for the established SDSU Ph.D. in Electrical Engineering were included.²⁰ The average number of doctoral graduates for mature regional Mechanical Engineering programs is two per year. The Ph.D. program in Electrical Engineering (E.E.) at SDSU has been meeting or exceeding that number. Given these figures and the estimated enrollment in the proposed program, a projected number of doctorates awarded was developed.

Estimates	Fiscal Years*			
	1 st FY 21	2 nd FY 22	3 rd FY 23	4 th FY 24
Students new to the university	2	2	3	3
Students from other university programs	3	0	0	0
Continuing students		5	4	5
=Total students in the program (fall)	5	7	7	8
Program credit hours (major courses)**	105	147	147	168
Graduates	0	1	2	2

¹⁹ Developmental consultants are experts in the discipline hired by the university to assist with the development of a new program (content, courses, experiences, etc.). Universities are encouraged to discuss the selection of developmental consultants with Board staff.

²⁰ Source: National Science Foundation, National Center for Science and Engineering Statistics, <https://www.nsf.gov/statistics/>. Institutional profiles available at <https://ncesdata.nsf.gov/profiles/>. 2016 is the latest year for which data are available.

*Do not include current fiscal year.

** Assumes students are registered for 10 credit hours in the fall and spring terms and 1 credit in summer (21 credits total per year). This is the total number of credit hours generated by students in the program in the required or elective program courses. The same numbers are used in Appendix B – Budget.

10. Is program accreditation available? If so, identify the accrediting organization and explain whether accreditation is required or optional, the resources required, and the University’s plans concerning the accreditation of this program.

There is no program accreditation available for the proposed program.

11. Does the University request any exceptions to any Board policy for this program? Explain any requests for exceptions to Board Policy. If not requesting any exceptions, enter “None.”

None.

12. Delivery Location²¹

A. Complete the following charts to indicate if the university seeks authorization to deliver the entire program on campus, at any off campus location (e.g., UC Sioux Falls, Capital University Center, Black Hills State University-Rapid City, etc.) or deliver the entire program through distance technology (e.g., as an online program)?

The University does not request authorization to deliver the entire program through distance technology. SDSU and SDSM&T intend to use the D2L platform, the Access Grid and the Dakota Digital Network (DDN) to share courses and augment the collaboration.

	Yes/No	Intended Start Date
On campus	Yes	2020-2021 Academic Year

	Yes/No	If Yes, list location(s)	Intended Start Date
Off campus	No		

	Yes/No	If Yes, identify delivery methods ²²	Intended Start Date
Distance Delivery (online/other distance delivery methods)	No		

²¹ The accreditation requirements of the Higher Learning Commission (HLC) require Board approval for a university to offer programs off-campus and through distance delivery.

²² Delivery methods are defined in [AAC Guideline 5.5](#).

B. Complete the following chart to indicate if the university seeks authorization to deliver more than 50% but less than 100% of the certificate through distance learning (e.g., as an online program)?²³

	Yes/No	If Yes, identify delivery methods	Intended Start Date
Distance Delivery (online/other distance delivery methods)	Yes	D2L, Access Grid and the Dakota Digital Network	2020-2021 Academic Year

13. Cost, Budget, and Resources: Explain the amount and source(s) of any one-time and continuing investments in personnel, professional development, release time, time redirected from other assignments, instructional technology & software, other operations and maintenance, facilities, etc., needed to implement the proposed major. Address off-campus or distance delivery separately. Complete Appendix B – Budget and briefly summarize to support Board staff analysis.

The program budget is provided in Appendix B.

The needed infrastructure and resources necessary to offer the proposed program are in place at SDSU. The SDSU Jerome J. Lohr College of Engineering will direct \$42,000/yr. in base funding to provide two 49% Ph.D. graduate assistantships (1.0 FTE total).

Dissertation research expenses will be borne by grants and contracts awarded to participating faculty members.

14. Board Policy 2:1 states: “Independent external consultants retained by the Board shall evaluate proposals for new graduate programs unless waived by the Executive Director.” Identify five potential consultants (including contact information and short 1-2 page CVs) and provide to the System Chief Academic Officer (the list of potential consultants may be provided as an appendix). In addition, provide names and contact information (phone numbers, e-mail addresses, URLs, etc.) for accrediting bodies and/or journal editors who may be able to assist the Board staff with the identification of consultants.

Since this program is proposed as a collaboration with the existing Ph.D. in Mechanical Engineering program at SDSM&T, the requirement for the independent external consultants to evaluate the proposal is requested to be waived.

15. Is the university requesting or intending to request permission for a new fee or to attach an existing fee to the program (place an “X” in the appropriate box)? If yes, explain.

YES NO

Explanation (if applicable):

The Ph.D. in Mechanical Engineering will be supported from existing program fees applied to the ME prefix.

16. New Course Approval: New courses required to implement the new graduate program may receive approval in conjunction with program approval or receive approval separately. Please check the appropriate statement:

²³ This question responds to HLC definitions for distance delivery.

YES,

the university is seeking approval of new courses related to the proposed program in conjunction with program approval. All New Course Request forms are included as Appendix C and match those described in section 5D.

NO,

the university is not seeking approval of all new courses related to the proposed program in conjunction with program approval; the institution will submit new course approval requests separately or at a later date in accordance with Academic Affairs Guidelines.

17. Additional Information:

Additional Admission Requirements

GRE: Not required

TOEFL: Score of 550 paper-based, 79 Internet-based

IELTS: 5.5

Appendix A

Ph.D. in Mechanical Engineering – Student Learning Outcomes

Individual Student Outcome	Program Courses that Address the Outcomes						
	ME 790*	GSR 601*	ME 898D*	ME Electives	Qualifying Exam*	Comprehensive Exam*	Dissertation Defense*
1. Acquire and apply the knowledge and skills to make an original contribution to the mechanical engineering field.			X	X	X	X	X
2. Conduct independent research within a supportive framework.			X			X	X
3. Understand and critically evaluate the relevant engineering literature.	X		X	X		X	X
4. Communicate relevant engineering principles and theories by written, oral, and visual means.	X		X	X		X	X
5. Apply engineering principles and procedures to the recognition, interpretation, and understanding of prior and current knowledge in the field.	X		X	X	X	X	X
6. Exhibit an appropriate awareness of and commitment to the ethical conduct of research.		X	X			X	X

Appendix B

South Dakota State University, Ph.D. in Mechanical Engineering

1. Assumptions

		1st FY21	2nd FY22	3rd FY23	4th FY24
<i>Headcount & hours from proposal</i>					
Fall headcount (see table in proposal)		5	7	7	8
Program FY cr hrs, On-Campus		105	147	147	168
Program FY cr hrs, Off-Campus		0	0	0	0
Faculty, Regular FTE	See p. 3	0.25	0.25	0.25	0.25
Faculty Salary & Benefits, average	See p. 3	\$110,203	\$110,203	\$110,203	\$110,203
Faculty, Adjunct - number of courses	See p. 3	0	0	0	0
Faculty, Adjunct - per course	See p. 3	\$1,000	\$1,000	\$1,000	\$1,000
Other FTE (see next page)	See p. 3	1.00	1.00	1.00	1.00
Other Salary & Benefits, average	See p. 3	\$41,053	\$41,053	\$41,053	\$41,053

2. Budget

<i>Salary & Benefits</i>					
Faculty, Regular		\$27,551	\$27,551	\$27,551	\$27,551
Faculty, Adjunct (rate x number of courses)		\$0	\$0	\$0	\$0
Other FTE		\$41,053	\$41,053	\$41,053	\$41,053
	S&B Subtotal	\$68,604	\$68,604	\$68,604	\$68,604
<i>Operating Expenses</i>					
Travel		\$2,000	\$2,000	\$2,000	\$2,000
Contractual Services		\$0	\$0	\$0	\$0
Supplies & materials		\$1,500	\$2,500	\$2,500	\$2,500
Capital equipment		\$0	\$0	\$0	\$0
	OE Subtotal	\$3,500	\$4,500	\$4,500	\$4,500
	Total	\$72,104	\$73,104	\$73,104	\$73,104

3. Program Resources

Off-campus support tuition/hr, HEFF net	GR	\$399.05	\$399.05	\$399.05	\$399.05
Off-campus tuition revenue	hrs x amt	\$0	\$0	\$0	\$0
On-campus support tuition/hr, HEFF net	GR	\$288.55	\$288.55	\$288.55	\$288.55
On-campus tuition revenue	hrs x amt	\$30,298	\$42,417	\$42,417	\$48,477
Program fee, per cr hr (if any)	\$80.55	\$8,458	\$11,841	\$11,841	\$13,532
Delivery fee, per cr hr (if any)	\$0.00	\$0	\$0	\$0	\$0
University redirections		\$42,000	\$42,000	\$42,000	\$42,000
Community/Employers		\$0	\$0	\$0	\$0

Grants/Donations/Other	\$0	\$0	\$0	\$0
Total Resources	\$80,756	\$96,258	\$96,258	\$104,010

Resources Over (Under) Budget **\$8,652** **\$23,154** **\$23,154** **\$30,906**

Provide a summary of the program costs and resources in the new program proposal.

Estimated Salary & Benefits per FTE	Faculty	Other
Estimated salary (average) - explain below	\$88,943	\$40,647
University's variable benefits rate (see below)	0.1438	0.0100
Variable benefits	\$12,790	\$406
Health insurance/FTE, FY18	\$8,470	\$0
<i>Average S&B</i>	\$110,203	\$41,053

Explain faculty used to develop the average salary & fiscal year salaries used. Enter amount above.

The FY19 salaries of 9 people in the SDSU M.E. department were averaged to determine the average salary.

Explain adjunct faculty costs used in table:

Explain other [for example, CSA or exempt] salary & benefits. Enter amount above.

Other personnel are two Ph.D. Graduate Assistants at a base salary of \$40,647 for FY19. Graduate Assistantships are 49% time (0.5 FTE each). Fringe benefits are estimated at 1% of salary. Figures are based on the SDSU research budget template.

Summarize the operating expenses shown in the table:

Operating expenses will cover costs associated with faculty duties, including computer software and hardware, phone, copying/printing, resource materials and lab expendables. Travel support is required for attendance at conferences and to meet with funding agencies (\$2000/faculty FTE/yr). Capital equipment funds are for new and replacement research laboratory equipment .

Summarize resources available to support the new program (redirection, donations, grants, etc).

The SDSU Jerome J. Lohr College of Engineering will direct \$42,000/yr in base funding to provide two 49% Ph.D. graduate assistantships (1.0 FTE total).

State-support: Change cell on page 1 to use the UG or GR net amount.

Off-Campus Tuition, HEFF & Net	FY19			
	Rate	HEFF	Net	
Undergraduate	\$340.05	\$39.11	\$300.94	<i>Change cell on page 1 to point to your net</i>
Graduate	\$450.90	\$51.85	\$399.05	
Externally Supported	\$40.00			

State-support: Change cell on page 1 to use the UG or GR net amount for your university.

On-Campus Tuition, HEFF & Net	FY19			
	Rate	HEFF	Net	
UG Resident - DSU, NSU	\$243.30	\$27.98	\$215.32	<i>Change cell on page 1 to point to your net</i>
UG Resident - SDSU, USD	\$248.35	\$28.56	\$219.79	
UG Resident - BHSU	\$254.20	\$29.23	\$224.97	<i>Change cell on page 1 to point to your net</i>
UG Resident - SDSMT	\$249.70	\$28.72	\$220.98	
GR Resident - DSU,NSU	\$319.40	\$36.73	\$282.67	<i>Change cell on page 1 to point to your net</i>
GR Resident - SDSU, USD	\$326.05	\$37.50	\$288.55	
GR Resident - BHSU	\$328.20	\$37.74	\$290.46	<i>Change cell on page 1 to point to your net</i>
GR Resident - SDSMT	\$324.85	\$37.36	\$287.49	
UG Nonresident - DSU,NSU	\$342.40	\$39.38	\$303.02	<i>Change cell on page 1 to point to your net</i>
UG Nonresident - BHSU	\$355.70	\$40.91	\$314.79	
UG Nonresident - SDSU, USD	\$360.50	\$41.46	\$319.04	<i>Change cell on page 1 to point to your net</i>
UG Nonresident - SDSMT	\$391.10	\$44.98	\$346.12	
GR Nonresident - DSU,NSU	\$596.30	\$68.57	\$527.73	<i>Change cell on page 1 to point to your net</i>
GR Nonresident - BHSU	\$612.40	\$70.43	\$541.97	
GR Nonresident - SDSU, USD	\$626.85	\$72.09	\$554.76	<i>Change cell on page 1 to point to your net</i>
GR Nonresident - SDSMT	\$652.00	\$74.98	\$577.02	
UG Sioux Falls Associate Degree	\$275.40	\$31.67	\$243.73	<i>Change cell on page 1 to point to your net</i>

Variable Benefits Rates

University	FY19	
BHSU	14.64%	<i>Change the benefits rate cell in the table on page 2 to point to the rate for your university.</i>
DSU	14.36%	
NSU	14.31%	
SDSM&T	14.20%	
SDSU	14.38%	
USD	14.34%	