

**SOUTH DAKOTA BOARD OF REGENTS**

**Full Board**

**AGENDA ITEM: 23 – B**

**DATE: June 10-11, 2015**

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**SUBJECT: Intent to Plan: SDSU Master of Engineering**

South Dakota State University (SDSU) requests approval to develop a proposal for a professional engineering master’s degree program, the Master of Engineering (M.Eng). The professional master’s program differs from traditional master’s programs by focusing on workplace success skills rather than emphasizing substantial research projects. The curriculum integrates applied management, technical writing, project management, and specific industry-sector skills designed to help engineers transition into professional leadership roles. An industry advisory board will advise the Dean of Engineering on program content to reflect regional trends in technology and applications. The proposed curriculum would allow full-time students to complete the program on campus within one year following their bachelors’ degree; professionals already working in the field can reasonably expect degree completion within two to four years.

(Continued)

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**RECOMMENDED ACTION OF THE EXECUTIVE DIRECTOR**

Authorize SDSU to develop a proposal for a Master of Engineering (M.Eng) with the following conditions:

1. The university will research existing curricula, consult with experts concerning the curriculum, and provide assurance in the proposal that the program is consistent with current national standards and with the needs of employers.
2. The proposal will define the specific knowledge, skills, and competencies to be acquired through the program, will outline how each will be obtained in the curriculum and will identify the specific measures to be used to determine whether individual students have attained the expected knowledge, skills, and competencies.
3. The university will not request new state resources and the program proposal will identify the sources and amounts of all funds needed to operate the program and the impact of reallocations on existing programs.
4. The university will complete a feasibility assessment for the program as well as continuing consulting with SDSM&T on curriculum development for the new program proposal, including exploring the possibilities of sharing courses and resources.

### **University Mission and System Strategic Goals**

South Dakota Board of Regents policy 1:10:2 establishes the mission of SDSU to serve 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 proposed program aligns with SDSU’s strategic plan, IMPACT 2018. In addition, the proposed program is consistent with the Board of Regents 2014-2020 Strategic Plan, including growing the number of graduate degrees awarded as described in Goal 1, growing the number of graduate programs as described in Goal 2, and the development of academic programs that align with state workforce needs as described in Goal 3.

### **Related Programs in the System**

There are existing master’s degree programs in engineering disciplines at SDSU and South Dakota School of Mines and Technology (SDSM&T) that utilize both thesis and coursework only options. SDSM&T offers related coursework only MS programs including, but not limited to, Engineering Management, Mining and Engineering Management, and Construction Engineering and Management. However, SDSU proposes differentiating the proposed Master of Engineering degree from the Master of Science degree by omitting research coursework, decreasing the number of graduate level engineering credits, adding a cross-disciplinary leadership and management sequence, and involving an industry advisory board to provide advice on program content.

### **Workforce Need, Student Demand, Projected Graduates**

Expected growth in engineering and management positions within the state is 12.5% through 2020. SDSU expects the Master of Engineering program to support the South Dakota Department of Transportation (SDDOT) recruitment to fill leadership positions created through retirements. The number of engineering master’s degrees awarded nationally has grown by 20% since 2004, evidence of increasing student demand and interest. SDSU expects 15 students to enroll in the program per year.

### **Board Policy**

SDSU is not requesting any exceptions to Board Policy.

### **Off Campus and Distance Delivery**

SDSU intends to request authorization to deliver the program online with a tentative beginning date in Spring of 2016.

### **Budget and Resources**

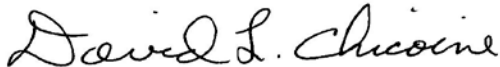
SDSU does not request any new State resources to implement or maintain the proposed program. SDSU will fund the program through reallocation of existing resources.

**South Dakota Board of Regents**  
**Intent to Plan for a Master of Engineering (M.Eng)**

<b>UNIVERSITY:</b>	<b>South Dakota State University</b>
<b>DEGREE(S) AND TITLE OF PROGRAM:</b>	<b>Master of Engineering (M.Eng)</b>
<b>INTENDED DATE OF IMPLEMENTATION:</b>	<b>Fall 2016</b>

**University Approval**

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



\_\_\_\_\_  
 President of the University

\_\_\_\_\_  
 May 1, 2015

\_\_\_\_\_  
 Date

After approval by the President, a signed copy of the proposal should be transmitted to the Executive Director. Only after Executive Director review should the proposal be posted on the university web site and the Board staff and the other universities notified of the URL.

**1. What is the general nature of the proposed program? What is the expected demand for graduates in South Dakota? What is the need for the proposed program?**

*General Nature of the Proposed Program*

South Dakota State University requests approval to develop a professional engineering master's degree program, the Master of Engineering (M.Eng). The proposed curriculum is 30 credits, coursework only, and delivered in such a way that matriculating students can complete the program on campus within a year following their bachelors' degree. For engineering professionals already working in their field, it is expected they could complete the degree while simultaneously taking graduate courses within a reasonable timeframe of two to four years.

The curriculum is modeled after professional engineering programs that integrate applied management, technical writing, project management, and specific industry-sector skills and is, in part, in response to the National Academies of Engineering (NAE) concept of the Engineer of 2020.<sup>1</sup> The NAE proposes the master's degree should be the recognized professional degree and a bachelor's would serve as the gateway to the engineer-in-training credential. Likewise, the National Council of Examiners for Engineering and Surveying, the licensing body for engineering, has proposed changes to its Model Rules and Model Law to require 30 credits of graduate study beyond the bachelor's degree.

Professional master's programs differ from traditional, academic master's programs in that the former focuses on skills needed to succeed in the workplace while the latter encourages a substantial research project carried out independently by the student. The proposed Master of Engineering degree program at SDSU provides advanced engineering coursework complemented by an applied management and leadership development core. Technical organizations

<sup>1</sup> American Society for Civil Engineering (ASCE). Raise the Bar For Engineering. <http://www.raisethebarforengineering.org/future-engineer/#Engineer%20of%202020>

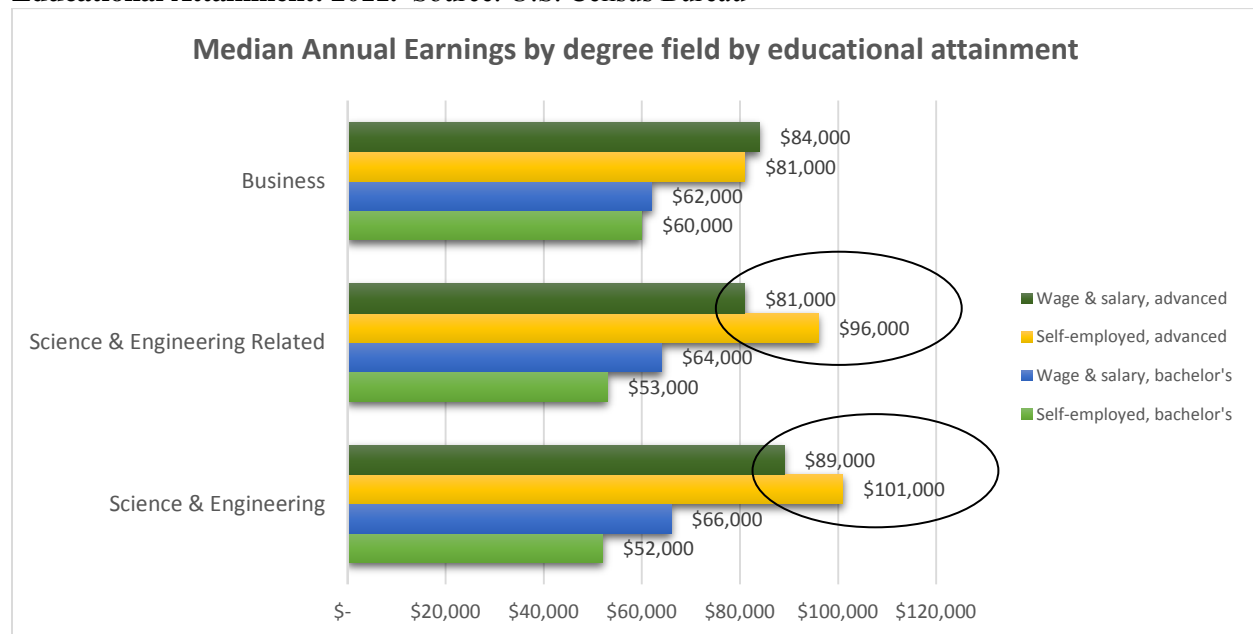
**South Dakota State University**  
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traditionally have progression ladders that move degreed engineers into management positions early in their career; this program is tailored to facilitate graduates' successful transition into leadership roles. To assure we are aligned with regional business and industry expectations, an advisory council will be formed to provide guidance on expected outcomes, emerging technology and industry trends.

*Expected Demand for Graduates in South Dakota*

Professional master's degrees are increasingly viewed as a 'capstone' or finishing program for individuals seeking a professional credential that will build upon their undergraduate program of study. These professional engineering programs provide technical and intellectual development that can open the door to opportunities for leadership roles within their organization, ultimately resulting in competitive businesses as well as economic development for the state and region. The need for an advanced degree as a competitive edge in the workplace has been well documented. In the Almanac of Higher Education (2014), a survey of 165,000 first-time full-time students entering college in fall 2013 indicated 42% planned on going on for a master's degree.<sup>2</sup> Individuals with a master's degree can expect to nearly double their earnings over a lifetime versus those with a bachelor's degree. The case for an advanced (graduate) science and engineering degree is supported in the data. Figure 1 shows that individuals majoring in engineering and related fields earned 50% more with an advanced degree contrasted with their counterparts in business career fields who earned 30% more with an advanced degree.<sup>3</sup> Clearly, an advanced degree such as the master's is financially rewarding for those who elect to take advantage of the opportunity.

**Figure 1. Median Annual Earnings by Field of Bachelor's Degree by Type of Worker and Educational Attainment: 2011.** Source: U.S. Census Bureau



<sup>2</sup> Almanac of Higher Education 2014-15. *The Chronicle of Higher Education*, Vol. 60 (45), August 22, 2014.

<sup>3</sup> Ryan, C. (October 2012). Field of degree earnings by selected employment characteristics: 2011. U.S. Census Bureau. Retrieved from: <http://www.census.gov/hhes/socdemo/education/>

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Annually, the South Dakota Department of Transportation (SDDOT) recruits a score of graduating engineering students from the two engineering programs in South Dakota to fill vacant entry-level engineering positions. As seasoned SDDOT engineers retire many of the new engineering hires are groomed to assume leadership positions at SDDOT after only few years of employment. This has created a great demand for frequent technical and managerial training activities. Through a recent South Dakota Board of Regents initiative, SDDOT and the two engineering in the state started a discussion to identify: 1) technical and leadership training needs for SDDOT engineers and 2) educational opportunities that the state's engineering programs can provide to help SDDOT meet those needs. The proposed M.Eng program at SDSU creates an ideal venue to prepare the future cadre of engineering leaders at SDDOT, other state and local governments, and local and regional industry.

In 2013, the number of engineering master's degrees awarded nationally grew 6.9% to 49,483 reflecting the ninth consecutive year of increases and a 20% increase in the total number of engineering master's degrees reviewing data back to 2004.<sup>4</sup> This growth underscores the demand for the technical graduate degree as the credential of choice for advancement and professional growth for engineers.

The South Dakota Department of Labor and Regulations projects the disciplines of engineering and management will grow 7 – 18% through 2022. There are currently 981 licensed professional engineers and 2256 engineering interns registered in South Dakota.<sup>5</sup> While we do not know how many have earned an engineering graduate degree, it is reasonable to expect there is pent-up demand for the graduate professional engineering programming for place bound engineers in South Dakota and the region.<sup>6</sup>

*Need for the Proposed Program*

The National Society of Professional Engineers (NSPE) provides an overview of each state's requirements for professional development. In most states, there is an expectation for advanced technical development in the engineering discipline as well as management professional development, recognizing the career path most engineers take following graduation. For many engineers, graduate programs in business administration traditionally have been the venue to learn management theory and practice, and graduate engineering programs served to enhance knowledge of the discipline. Neither is the ideal solution particularly for individuals employed in organizations in advanced technologies. For these reasons, there is a growing recognition of the value of a professional master's degree program, particularly for engineers and scientists. The National Council of Examiners for Engineering and Surveying (NCEES) Model Rules and Model Law is currently being revised in support of education beyond the bachelor's degree including graduate programming, management courses, and relevant professional development as part of the professional engineer licensure maintenance requirements.<sup>7</sup> This proposed change in licensure rules is being discussed nationally.

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<sup>4</sup> Yoder, B.L. (2014). Engineering by the numbers. American Society for Engineering Education. Retrieved from: [http://www.asee.org/papers-and-publications/publications/14\\_11-47.pdf](http://www.asee.org/papers-and-publications/publications/14_11-47.pdf)

<sup>5</sup> South Dakota Department of Labor and Regulation – Board of Technical Professions. Retrieved from: <http://dlr.sd.gov/bdcomm/btp/>

<sup>6</sup> Jones, J.I. (2014). An overview of employment and wages in science, technology, engineering, and math (STEM) groups. *Beyond the Numbers: Employment and Unemployment, U.S. Bureau of Labor Statistics, April 2014*, 3 (8).

<sup>7</sup> NCEES Approves Revised Approach to Education Initiative. <http://ncees.org/about-ncees/news/ncees-approves-revised-approach-education-initiative/>

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Table 1 provides summary data for employment growth within the state for the period 2010 to 2020 for engineering and management positions that would likely be filled by degreed engineers.<sup>8</sup> Projected growth for these combined occupations for the period is an average of 12.5%.

**Table 1. South Dakota Occupational Projections for Engineering and Engineering-Related Management Positions.** Source: SD Dept. of Labor and Regulations.

SOC* Code	Occupational Title	2010 Demand	2020 Projections	Percent Change
17-2051	Civil Engineers	800	865	8.10%
17-2061	Computer Hardware Engineers	75	95	26.70%
17-2071	Electrical Engineers	195	205	5.10%
17-2072	Electronics Engineers, except Computer	145	160	10.30%
17-2081	Environmental Engineers	160	180	12.50%
17-2141	Mechanical Engineers	465	520	11.80%
11-3051	Industrial Production Managers	350	415	18.60%
11-9041	Architectural and Engineering Managers	140	150	7.10%

**2. What is the relationship of the proposed program to the University's mission as provided in South Dakota statute and Board of Regents Policy?**

South Dakota Board of Regents policy 1:10:2 provides the mission of South Dakota State University and notes the codified law that establishes our mission:

*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.*

<sup>8</sup> South Dakota Department of Labor and Regulation, Occupational Employment Projections. [http://dlr.sd.gov/lmic/occupation\\_projections.aspx](http://dlr.sd.gov/lmic/occupation_projections.aspx)

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SDBOR policy 1:10:2 continues with the degrees SDSU is authorized to provide:

*The following curriculum is approved for South Dakota State University.*

*A. Undergraduate Programs*

*Associate degree programs in General Studies and General Agriculture.*

*Baccalaureate programs in the agricultural sciences, aviation, education, engineering and technology, human sciences, humanities and liberal arts, nursing, performing and visual arts, pharmaceutical sciences, physical and biological sciences, and social sciences.*

*B. Graduate Programs*

*Masters degrees in arts and sciences, agricultural and biological sciences, human sciences, education and counseling, engineering and technology, and nursing. Doctor of Philosophy Degrees in Agriculture and Engineering, and the Physical, Biological, and Social Sciences. Professional programs – the Doctor of Pharmacy (Pharm D), Nursing (DNP).<sup>9</sup>*

The proposed program will strengthen our ability to fulfill our land-grant mission, and support the stated goals for IMPACT 2018, our institutional strategic plan. Specifically:

Goal 1: Promote academic excellence through quality programs, engaged learners and an innovative teaching and learning environment.

- The proposed Masters of Engineering program will prepare graduates to meet the needs of our constituents to ‘build a highly educated workforce that develops tomorrow’s leaders.’

Goal 2: Generate new knowledge, encourage innovations and promote...economic development for South Dakota, the region, the nation and the world.

- The new master’s program will provide professional development and career advancement opportunities for graduates as well as competitive advantage for organizations that employ them.

Goal 3: Extend the reach and depth of the University by developing strategic programs and collaborations.

- This degree will provide ‘graduate, professional and continuing education focused on traditional and adult learners across the state, in the region, the nation and globally.’

Goal 4: Secure human and financial resources to ensure high performance through enhanced financial, management and governance systems.

- The program will leverage existing resources within the college thereby growing enrollment and strengthening our financial performance.

**3. Are there any related programs in the regental system? If there are related programs, why should the proposed program be added? If there are no related programs within the system, enter “None.”**

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<sup>9</sup> South Dakota Board of Regents Policy Manual. Retrieved from: <http://www.sdbor.edu/policy/1-Governance/documents/1-10-2.pdf>

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Yes. There are existing master's degree programs in engineering disciplines at SDSU and SDSMT that utilize both thesis and coursework only options.

SDSU & SDSMT offer Master of Science programs in:

- Civil and Environmental Engineering
- Electrical Engineering
- Mechanical Engineering

SDSU also offers a Master of Science degree in Agriculture and Biosystems Engineering. SDSMT offers three similar distance education M.S. programs focusing on leadership and management in the engineering field that do not require a thesis, including Engineering Management, Mining and Engineering Management, and Construction Engineering and Management.

We are differentiating this new program from existing engineering Master of Science programs currently offered via the omission of research coursework, decreasing the number of graduate level engineering credits, and the addition of a cross-disciplinary leadership and management sequence. To assure the program is relevant and effective, our Master of Engineering curriculum will be developed in response to industry stakeholder employers rather than the graduate faculty of the institution – *an important distinction*. An industry advisory board will advise the Dean of Engineering, on an ongoing basis, on program content to reflect regional trends in technology and applications, learning objectives and expected outcomes, as well as program delivery. Additionally, the proposed response to the industry advisory board's advice will be forwarded to the Dean of the Graduate School for review. In this fashion, SDSU will ensure the program continues to meet the changing needs of the industrial sector it serves.

The proposed Master of Engineering degree program provides advanced engineering coursework complemented by an applied management and leadership development core. It is not intended to provide academic preparation for advanced research degrees such the Doctor of Philosophy. SDSU will consult with SDSMT on curriculum development for the new program proposal, including exploring the possibilities of sharing courses and resources. However, due to the unique focus on the industry advisory board's input regarding program outcomes, the choice of courses to include in the curriculum may be constrained.

**4. Are there related programs at public colleges and universities in Minnesota, North Dakota, Montana, and Wyoming? If there are related programs in these states list below under each state and explain why the proposed program is needed in South Dakota. If there are no related programs in a state, enter "None" for that state.**

Minnesota:

University of Minnesota – Duluth: Professional Master of Engineering (MEng)

North Dakota:

North Dakota State University: Master of Engineering (M.E.)

University of North Dakota: Master of Engineering (M.E.)



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Montana:

Montana State University: Professional Master of Engineering (M.Eng)

Wyoming:

None

The proposed Master of Engineering (M.Eng) degree program at SDSU is similar to these regional programs as it will provide an alternative to the research-oriented graduate degree for practicing professional and early career engineers. South Dakota engineers benefit by no longer having to go out of state to earn the professional engineering degree.

**5. Are students expected to be new to the university or redirected from other programs? How many majors are expected in the first years of the program? How many graduates are expected?**

New: yes. Redirected: no. There is pent-up demand for graduate professional engineering programming, i.e., the Master of Engineering, for place bound engineers in South Dakota and the region. As noted earlier, there are currently 981 licensed professional engineers and 2,256 engineering interns registered in South Dakota. Of this population, it is expected that 50% would likely earn an advanced degree in their early career based on national education achievement trends. For planning purposes, we would anticipate enrollment from this pool of potential students of 15 new part-time graduate students enrolled in classes in the program per year.

We will purposefully recruit senior-level students currently in SDSU engineering and closely-related programs to apply for admission. This will mean they could start taking graduate courses early as the final semester of their senior year. In this situation, SDSU would be *retaining* students at the university beyond graduation as they transition into this professional graduate program. Enrollments of 10-13 students per year are expected. This would produce a total, ongoing annual enrollment of 25-28 students at a 50/50 mix of continuing recent engineering graduates and working professionals.

**6. Does the university intend to seek authorization to deliver this entire program at any off-campus locations? If yes, enter location(s) and intended start date(s). Does the university intend to seek authorization to deliver this entire program by distance technology? If yes, identify delivery method(s) and intended start date(s).**

Off-campus	No
Distance delivery	Yes. Internet Synchronous starting Spring 2016

**7. What are the University's plans for obtaining the resources needed to implement the program? Indicate "yes" or "no" in the columns below.**

	Development/Start-up	Long-term Operation
Reallocate existing resources	Yes	Yes
Apply for external resources	No	No

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Ask Board to seek new State resources	No	No
Ask Board to approve new or increased student fee	No	No

**8. Curriculum Example: Provide (as Appendix A) the curriculum of a similar program at another college or university.** *The Appendix should provide the required and elective courses in the program. Catalog pages or web materials may be used. Identify the college or university and explain why the program may be used as one model when the proposed program is developed.*

*Curriculum Examples in Appendix A:*

Iowa State University	Mechanical Engineering M.Eng.
Colorado State University	Mechanical Engineering M.E. Civil and Environmental Engineering M.E.
Montana State University	Electrical Engineering M.Eng. Mechanical Engineering M.Eng.

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**APPENDIX A**

**Master of Engineering (M.Eng) in Mechanical Engineering  
 Iowa State University**

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

The Mechanical Engineering MEng program at Iowa State University is a 30 credit program of study designed for working professionals or as an extension of the bachelor’s degree.

Mechanical Engineering Core 15 credits

- Select courses from the following disciplinary areas
  - Design and Optimization
  - Dynamic Systems and Controls
  - Materials Processing and Mechanics
  - Thermo-Fluid Sciences

Mathematics & Statistics 3 credits

- Any 300 level course or higher

Professional Development 3 credits

*(select one - \* denotes online)*

- ConE 380\*: Engineering Law
- Econ 355: International Trade and Finance
- HCI 594X\*: Organizational Application of Collaborative Technology
- HG ED: 561 College Teaching
- IE 570\*: Systems Engineering and Project Management
- ME 584\*: Technology, Globalization and Culture
- MGMT 472: Management of Diversity
- SCM 501\*: Supply Chain Management
- Any foreign language course
- Other courses, as approved by the POS committee

Electives 9 credits

- Any course that will round out the professional program
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**Master of Engineering (M.E.) in Mechanical Engineering  
 Colorado State University**

<http://www.engr.colostate.edu/me/pages/graduate/>

Plan C – Coursework

- Minimum 30 credits of regular coursework (no thesis, independent study, or practicum)
- Minimum 15 credits of Mechanical Engineering courses (must have the prefix MECH)
- Advisor Required (typically the Associate Department Head for Graduate Studies)
- No thesis or Graduate Committee required

Materials Science Emphasis:

Required Core: 15 Credits

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MECH 431 – Metals and Alloys (3 cr.)  
 MECH 530 – Advanced Composite Materials (3 cr.)  
 MECH 532 – Materials Issues in Mechanical Design (3 cr.)  
 MECH 411 – Manufacturing Engineering (3 cr.)  
 MECH 531 – Materials Engineering (3 cr.)

Select 15 credits from these electives:

MECH 501 – Engineering Project Management and Program Management (3 cr.)  
 MECH 502 – Advanced/Additive Manufacturing Engineering (3 cr.)  
 MECH 512 – Reliability Engineering (3 cr.)  
 MECH 570 – Bioengineering (3 cr.)  
 STAT 511 – Design and Data Analysis for Researchers I (4 cr.)  
 MECH 513 – Simulation Modeling and Experimentation (3 cr.)  
 MECH 525 – Cell and Tissue Engineering (3 cr.)  
 MECH 569 – Micro-Electro-Mechanical Devices (3 cr.)  
 MECH 573 – Structure and Function of Biomaterials (3 cr.)  
 STAT 512 – Design and Data Analysis for Researchers II (4 cr.)

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**Civil and Environmental Engineering Master of Engineering (M.E.)**  
**Colorado State University**

[http://www.engr.colostate.edu/ce/degreeinfo/master\\_eng\\_plan\\_c\\_prospective.shtml](http://www.engr.colostate.edu/ce/degreeinfo/master_eng_plan_c_prospective.shtml)

- Student must successfully complete a minimum of 30 total course credits
- No independent study credits will count toward graduation.
- At least 24 credits must be from courses of 500 level or above, 21 of which earned at CSU.
- A thesis or project paper is not required.
- Student's program of study must be approved by advisor – a graduate committee is not required.
- A final examination is not required.

Students must choose a Track:

Environmental Engineering (See example to follow)  
 Civil Infrastructure Engineering  
 Geotechnical Engineering  
 Irrigation Engineering  
 Structural Engineering  
 Water Resources Engineering  
 Water Resources Engineering Distance Program

Core Courses: (Choose 3 for 9 semester hours)

CIVE 440 Non-point source Pollution  
 CIVE 538 Aqueous Chemistry  
 CIVE 540 Environmental Biotechnology  
 CIVE 541 Advanced Water Treatment Processes

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Designated Electives: (choose 5 for at least 15 semester hours)

CIVE 413	Environmental River Mechanics
CIVE 437	Wastewater Treatment Plant Design
CIVE 439	Environmental Engineering Concepts
CIVE 516	Water Control and Measurement
CIVE 520	Physical Hydrology
CIVE 521	Hydrometry
CIVE 522	Engineering Hydrology
CIVE 524	Modeling Watershed Hydrology
CIVE 525	Water Engineering: International Development
CIVE 531	Groundwater Hydrology
CIVE 534	Applied and Environmental Molecular Biology
CIVE 544	Water Resources Planning and Management
CIVE 546	Water Resource System Analysis
CIVE 547	Statistics for Environmental Monitoring
CIVE 571	Pipe System Engineering and Hydraulics
CIVE 572	Analysis of Urban Water Systems
CIVE 573	Urban Stormwater Management
CIVE 576	Engineering Applications of GIS and GPS
CIVE 577	GIS in Civil and Environmental Engineering
CIVE 578	Infrastructure and Utility Management
CIVE 580	Models and Computational Methods in Civil Engineering
CIVE 532	Groundwater Wells and Pumps
CIVE 613	Stream Rehabilitation and Design

Open Electives: (2 needed)

Any 400 and above courses in a related field, e.g. business, sociology, soil science, environmental health, microbiology, agricultural economics, etc.

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**Electrical Engineering Master of Engineering (M.Eng)**

**Montana State University**

[http://www.coe.montana.edu/m\\_eng.html#EE](http://www.coe.montana.edu/m_eng.html#EE)

30 Credits

At least 15 credits must come from within one area of specialization:

- Electronic Devices & MEMS
- Telecommunication
- Signals & Controls
- Power & Energy
- Electromagnetics & Optics

The remaining courses must come from the approved list of 400 and 500-level courses. No pass/fail credits will be counted towards the degree.

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**Mechanical Engineering Master of Engineering (M.Eng)**  
**Montana State University**

[http://www.coe.montana.edu/m\\_eng.html#EE](http://www.coe.montana.edu/m_eng.html#EE)

30 Credits

*Core (18 credits)*

- EGEN 505: Advanced Engineering Analysis I (3 cr)
- EGEN 506: Numerical Solutions to Engineering Problems (3 cr)
- EM 525: Continuum Mechanics (3 cr)

Plus, a Mechanical Engineering course in each of the following areas (400 – 500 level):

- Materials (3 cr)
- Thermo/Fluids (3 cr)
- Solid Mechanics (3cr)

The remaining courses must come from the approved list of 400 and 500-level courses. No pass/fail credits will be counted towards the degree.