



MINERALS, MATERIALS AND SOCIETY

AN EDUCATION, RESEARCH AND
TRAINING PROGRAM

*SEPTEMBER 2019 ACADEMIC PROGRAM
UPDATE TO
OCTOBER 2018 APPLICATION*

**FACULTY SENATE
PROGRAM APPROVAL FORM
AND CHECKLIST**

FACULTY SENATE APPROVAL PROCESS

I. DESCRIPTION

A. Briefly describe the new program and state its objectives. The description also should focus on the knowledge, values, skills and other learning outcomes that program graduates will be expected to have acquired.

The University of Delaware (UD) has been awarded a grant from the Unidel Foundation to establish a new interdisciplinary graduate education, research and training program in *Minerals, Materials and Society (MMS)*. The purpose of this program is to build a campus-wide effort to bring together the University's leading faculty resources to create the first program of its kind in the United States that takes an interdisciplinary approach to linking science and policy around extractive supply chains and addressing timely issues facing all consumer industries of minerals and extractives. The program will be based in and administered by the Department of Geography in the College of Earth, Ocean and Environment. This program will be offered by both the CEOE and CAS.

Minerals and other extractives are fundamental natural resources in terms of their essential value as nutrients for agriculture and forestry as well as raw materials for infrastructure and technology. Yet, their study has often been relegated to highly technical sub-disciplines. With growing concerns over rare mineral scarcity for green energy technologies, as well conflict mineral and supply chain transparency issues pertaining to a broad array of precious metals and minerals for electronics and luxury products, there is a growing demand for education on the science and policy of economically important minerals.

Currently there is no interdisciplinary graduate certificate program for such training at an academic institution within the United States. Gemological training is done exclusively at specialized private institutes, and the closest comparable academic programs occur at universities where courses on topics such as mineral and mining economics and engineering are offered. No university offers an interdisciplinary program such as we are proposing here, with a combination of online and on campus course units with experiential learning modules.

The proposed MMS interdisciplinary graduate certificate program plans to be launched in 2020 and has the ambitious goal of becoming a world-leading education initiative dedicated to preparing students for game-changing leadership roles in finding knowledge-based solutions to the sustainability and corporate social responsibility (CSR) challenges of the global minerals and extractives industries. This unique program is driven by a market demand to transform today's model of business to make it fit for the future through transparency and sustainability that has gained an increasingly high profile nationally and internationally since the enactment of the UN Sustainable Development Goals and broad adoption of the OECD's Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.

The core curriculum will offer a 15 credit, online and on-campus delivery graduate certificate program, aimed at mid-career professionals looking to enhance their understanding of, and ability to address sustainability and supply chain issues in a variety of sectors. Courses will also be offered to qualified undergraduates and applicable graduate students looking to diversify their curriculum through electives. Elements and modifications of the core program will include:

- Online, graduate level courses in Responsible Resource Development will be offered through a partnership with the University of Queensland's Sustainable Minerals Institute, where Professor Ali also holds a Research Fellowship. The University of Queensland (UQ) was recently ranked Number One for Mining and Mineral Engineering education by the Shanghai Rankings. This unique partnership with UD allows UD students to access this highly ranked global curriculum. *(See G.2. for details on partnership agreement)*
- Required experiential field study/laboratory modules with mining, minerals and policy influencers (1 – 2 weeks). One experiential module will be required as part of the graduate certificate program, and these modules will also be offered separately to students and participants from outside the University to assist in generating income for overall program support.
 - Study Abroad Proposals are being drafted to incorporate the first international experiential modules into the program:
 - RUSSIA: Innovations in Legacy Mining: Lessons from Russia's Iron Ore Anomaly Region *(See G.2. for details on partnership with the Russian National State University in Moscow)*
 - AUSTRALIA: Ecological and Social Restoration of Mineral Landscapes: North Stradbroke Island/Darling Downs *(See G.2. for details on partnership with UQ)*
- **This program proposal is being updated (September 2019) to include the course CIEG631, Ecology Methods: Life Cycle and Material Flow Analyses for a Circular Economy (1 cr.) The course has been added to the Curriculum Chart on page 21 of this document. The Letter of Support from the Chair of CIEG is attached to this proposal.**
- Professional training – A goal of the program is to offer customized, intensive professional training to meet specific client needs, such as: 'Responsible Resource Development - Introduction to Available Auditing and Certification Programs' or 'Post-Mining Communities – Land and Water Reclamation and other post-Plant Closure Transition Challenges'.
 - Interest has already been expressed by ministers in the governments of Angola and Malawi for this type of intensive training. International institutional funders (GIZ, a German development organization; EPRM, European Partnership for Responsible Minerals) have expressed interest in funding this type of training at UD.
 - Our goal is to offer one professional training session during years one and two after the program launches, and two sessions annually in subsequent years.
- Research – *Minerals, Materials and Society* will provide a home for pertinent sector research, which will serve to cross-market the MMS graduate certificate and professional training programs, enhancing the profitability of the entire program.
 - **The Gemstones and Sustainable Development Knowledge Hub (GemHub)**, a Tiffany & Co Foundation-funded initiative that focuses on sustainable development in the gemstones sector: www.sustainablegemstones.org, is the leading hub for academic research in the

gemstones sector. The GemHub will be incorporated as one of the research arms of *Minerals, Materials and Society*.

- **The Jewelry Development Impact index (JDI) will be the technological research project of this new educational endeavor:** <https://sites.udel.edu/ceoe-mms/the-jewelry-development-impact-index-jdi/>. Launched from group discussions at a Jewelry Industry Summit in February 2017, the JDI project has been spearheaded by Elizabeth Orlando, Foreign Service officer in the Office of Threat Finance Countermeasures at the US Department of State, and Patricia Syvrud, immediate past Executive Director of the World Diamond Council and current member of the Board of Directors of the US Kimberley Process Authority. Created within the framework of the UN Indicators of Human Security, the JDI will be a relative and comparative country score that will measure and indicate the degree to which the jewelry and gemstone industries impact the economic and social well-being of the countries in which they function. A JDI Methodology workshop was held on September 7th with attendees from various stakeholder constituencies. (*JDI Methodology Workshop report attached in Annex*)
 - The JDI has already been recognized as an industry-wide initiative by The World Jewellery Confederation (CIBJO) in its annual report to the United Nations Economic and Social Council (ECOSOC). (*CIBJO statement to UN ECOSOC attached in Annex*)
 - The inaugural publication of the JDI is planned for January 2020 and will serve to cross-market the launch of the MMS program. Ms. Syvrud has joined the staff of UD as Program Development Manager for *Minerals, Materials and Society* and Ms. Orlando continues engagement with the project as Special Adviser to the JDI and MMS program. (*US Department of State letter of support attached in Annex*).

Learning Objectives and Outcomes

The learning objectives of the program will comprehensively cover multiple facets of the extractives industries such as responsible resource development, gemology and sustainable supply chains, environmental management issues, foundations of ecological economics, sustainable accounting frameworks, minerals sourcing and production, social aspects of mine utilization and rehabilitation, and gender and community issues and engagement.

Specific learning objectives of the MMS program for prospective students include, but aren't limited to:

1. Gain a systems analysis perspective of the mining/extractives industry complexities, impacts, risks and interdependencies.
2. Analytical skills - to analyze information and evaluate results to choose the best solution and solve problems; to consider relative costs and benefits of potential actions to drive conscientious decision making.
3. Understand the salience of social and environmental issues and how to minimize risk to their businesses, and society and ecology.
4. Learn innovative tools and techniques that promote successful and sustainable mining operation development and supply chain management.
5. Familiarity with global responsible sourcing, sustainability initiatives

6. Understanding successful socio-environmental and supply chain audits and certification

Learning outcomes will equip students with skill sets necessary not only to obtain jobs in a growing field of the economy but also become world leaders and game changers in this arena. To enable that success, specific learning outcomes of the MMS program will allow students to:

1. Gain a systems analysis perspective of the mining/extractives industry complexities, impacts, risks and interdependencies.
2. Gain familiarity with global responsible sourcing and sustainability initiatives.
3. Understand successful socio-environmental and supply chain audits and certification.
4. Develop new skills to help contribute to theoretical and practical frameworks for integrating economic and ecological systems in real world scenarios.
5. Ability to design & implement community awareness programs through developing effective strategies for community engagement
6. Develop Ecological Economic proficiency through a greater understanding that the economy is grounded in a larger ecological and social system.
7. Community Relations engagement - provide students with a thorough understanding of community aspects in the resource sector.

Completing the graduate certificate program *Minerals, Materials and Society (MMS)* will enable students to develop the professional and personal skills for a successful career in the extractives, mining and corporate social responsibility and sustainability industries.

II. RATIONALE AND DEMAND

A. Institutional factors.

1. Explain how the proposed program is compatible with the University purposes and objectives of General Education.

The University is uniquely qualified to be the home of this interdisciplinary program given its existing strengths and resources in key disciplines such as Energy and the Environment, Public Policy, Engineering, Marine Science, Business and Sustainability programs:

- The establishment of the Biden Institute at the University by former U.S. Vice President Joseph Biden in 2017 provides a high-impact policy platform for such professional programs.
- The University is home to one of the world's finest, small mineral collections, of which many specimens came directly from Tiffany & Co. This showcase collection will inspire and educate our students and build bridges with gem trading New York city and museum-rich Washington, DC, as well as other museums around the world.
- Through UD's existing courses, the MMS program can address mineral science and the art of designing and using gemstones for fashion, as well as the conservation of cultural artifacts that include precious minerals through our relationship with the Winterthur Museum, Garden and Library and Conservation Clinic.
- UD's location allows easy access to industry leaders, non-profit and civil servants, government officials and policy professionals in the mid-Atlantic and Northeastern US.
- The Department of Geology's implementation of successful "Master classes" on gemstones in May 2017 and September 2018 at UD in partnership with the University of Lausanne (which included a field trip to New York's American Museum of Natural History and gem trading

community in 2017 and a ‘Behind The Scenes’ tour of the National Gem Collection at the Smithsonian Institution in 2018), gives further momentum to move forward in this area to leverage this existing support from a world-renowned brand. These courses were marketed by the Department of Geology and were open to UD undergraduate and graduate geology students as well as others outside the university.

The ultimate success of this new *Minerals, Materials and Society* program will come from the collaborative efforts of the many valuable UD resources at our fingertips. We can create a truly unique educational platform that will set UD up as THE Go-To university for this timely and much-needed cross-disciplinary area of study.

2. Describe the planning process which resulted in the development and submission of this proposal. Describe any significant impact the proposed curricula might have on other instructional, research, or service programs of the University.

A Program Planning Committee was established in March 2018 and consisted of the following faculty and staff:

Name	UD College/Dept	Title
Estella Atekwana	College of Earth, Ocean and Environment	Dean of CEOE
Saleem Ali	CEOE, Blue and Gold Distinguished Professor of Energy and the Environment	Faculty Lead, Minerals, Materials and Society Program
Pat Syvrud	CEOE	Program Development Manager Minerals, Materials and Society Program
Mohsen Badiey	College of Engineering	Professor
Kim Bothi	College of Engineering	Director, Global Engineering
Sharon Fitzgerald	Library, Museums and Press	Mineralogical Museum Curator
George Irvine	Alfred Lerner College of Business and Economics	Director, Graduate Corporate Program Partnerships
Sandy Isenstadt	UD Center for Material Cultural Studies	Director of the Center for Material Culture Studies
George Luther	CEOE/Marine Science and Policy	Maxwell P. and Mildred H. Harrington Professor
Tom Rocek	CAS/Anthropology	Associate Professor
Syed Ismat Shah	College of Engineering	Professor, Materials Science and Engineering
Neil Sturchio	CEOE/Geology	Professor and Chair of Dept. of Geological Sciences
Vikramaditya Thakur	CAS/Anthropology	Assistant Professor
Monica Dominguez Torres	CAS/Art History	Associate Professor and Director of Undergraduate Studies

In person and teleconference Planning Committee Meetings were held monthly and/or as needed April – August 2018 to discuss curriculum and program development, and a broader, campus wide MMS Faculty Workshop was held and well attended by over 20 UD faculty members from multiple colleges on September 6, 2018. (*Faculty and Stakeholder Workshop report attached in Annex*)

- A Program Development Manager was hired April 1, 2018. Consequently, agreements have been drafted with the University of Queensland and the National Mining State University of Russia, and application to the United Nations SDG Academy to distribute the program’s pre-requisite

course *Natural Resources for Sustainable Development* has been submitted and accepted (membership in SDG Academy already in place).

- A Minerals, Materials and Society web site has gone live: <https://sites.udel.edu/ceoe-mms/>
- The MMS program and JDI were pre-marketed at the GIA Symposium October 7 – 9: <https://gia.eventsair.com/QuickEventWebsitePortal/gia-symposium-2018/gia-symposium>; and <https://gia.eventsair.com/QuickEventWebsitePortal/gia-symposium-2018/gia-symposium/ExtraContent/ContentSubPage?page=2&subPage=9>, and Chicago Responsible Jewelry Conference October 18 – 20: <https://www.chiresponsiblejewelryconference.com/speakers.html>

3. Describe how the proposed curricula would more fully utilize existing resources.

The *Minerals, Materials and Society* program will utilize and leverage a variety of valuable resources across campus and UD Colleges. Especially exciting will be the inclusion of a hands-on ‘Analytics of Minerals’ experiential course that will be held in the soon-to-be renovated Geology lab in Penny Hall, as part of the initial Unidel Foundation grant.

B. Student demand

1. Describe how enrollment projections have been derived. Show anticipated number of new majors and number of program graduates. Indicate the extent to which the new curriculum is expected to attract majors and the extent to which it will provide or electives to other majors. Indicate whether new admissions will be wholly new to the campus or internal transfers.

In 2014, according to the McKinsey Global Institute, 43 percent of executives said their companies seek to align sustainability with their overall business goals, mission, or values, up from 30 percent in 2012. Additionally, in a 2015 article “Leading in a World of Resource Constraints and Extreme Weather,” *Harvard Business Review* described three megatrends in corporate sustainability: resource constraints and rising commodity prices; climate change and extreme weather; and radical, technology-driven transparency, which are all issues that require new leadership and prompt the “rise of a Chief Sustainability Officer.”

Given the lack of comparable programs nationwide and the high importance and demand for these skills in a variety of sectors, we expect that this program will attract undergraduate and graduate students and industry professionals looking to gain the skills necessary to fill positions related to sustainability, responsible sourcing and supply chain transparency in extractives, energy and other corporate social responsibility arenas. Consumers and NGOs are demanding that companies and countries strive to make a positive impact in both new and mature market development, increasing the need for programs of this type. It is expected that the MMS program will attract these students and professionals and generate revenue for UD.

Specific reasons the *Minerals, Materials and Society* program will attract students are:

- Currently, minerals, mining and gem consumer training is done exclusively at specialized colleges and vocational institutions, but there is growing need for sustainable development training in this

area due to concerns about ‘conflict minerals’ and ‘post-carbon’ transition of communities. Both the United States and the European Union have ‘conflict mineral’ legislation which require publicly-traded companies to comply with supply chain traceability mandates.

- The gem industry, from mining to trading to manufacturing of jewelry, is a rapidly growing sector worldwide due to the rise of Asian consumer economies and the world’s largest single consumer of gold, classified as a ‘conflict mineral’ by the USA and EU.
- UD’s location allows easy access to industry leaders, non-profit and civil servants, and policy professionals in the mid-Atlantic and Northeastern US.

We are planning for the MMS program to start slowly but quickly build. A conservative estimate for Year One of the program is ten graduate certificate students, plus an additional five ‘outside program’ participants in the Experiential Laboratory modules. We expect that to double to twenty graduate certificate students in Year Two (ten second year graduate certificate students plus ten first year graduate certificate students, with ‘outside program’ participants in the Experiential Labs doubling to ten in Year Two.) We will be flexible in the enrollment pace for the program since it is geared towards mid-career professionals. However, there is an expectation that all courses should be completed within 18 months and no longer than 24 months. Students will need to maintain continuous registration according to UD current policy. We hope to consistently enroll ten new students per year, and hold one professional training session in Year One, increasing to two professional training sessions per year thereafter. (*MMS Business Plan attached in Annex*).

The program will be heavily marketed globally by a Program Director (to be secured) and faculty and staff who attend mining, minerals and responsible sourcing academic forums and industry events. As the first interdisciplinary program of its kind in the US and its focus on sustainability and responsible sourcing initiatives across sectors, we anticipate that the program will grow quickly both domestically and internationally and attract a global clientele for all aspects of the program (graduate certificate, experiential labs and customized professional training).

2. State whether the curriculum is designed to meet the needs of specific student clienteles, e.g., part-time students, currently employed professionals, non-traditional students, those preparing to reenter the job market, etc.

The program is being created to specifically attract beginning and mid-career professionals who are either looking to change careers or need to enhance their skills related to supply chain sustainability issues to fill the growing niche of corporate social responsibility/sustainability manager positions. The purposely created the ‘clicks and mortar’ design of the program, with many elective courses being offered online, and on-campus courses and experiential labs being offered in winter and summer sessions makes this program particularly appealing to this prospective student pool.

The MMS program is a graduate certificate program which does not add explicitly to the number of majors. What it does is create a unique opportunity to other existing majors, which increases the appeal of the Geography Department as a whole. Given the lack of comparable programs nationwide and the high importance and demand for these skills in the extractives industry, (See section E.1 for Demand details), we expect that this program will attract MS students and industry practitioners to the Geography Department. The current expectation of students and practitioners is based on a provisional status of the program and on the existing faculty of the Geography Department and participating departments across

campus. If the program proves to be popular, resource-based discussions will be undertaken to support required additional foundational courses of the program to grow the program further.

On September 7, a successful MMS Stakeholder Workshop was held to pre-market the program and attract the ideas and engagement of stakeholders from multiple industries and arenas. The workshop was well attended (27 in-person attendees from across sectors plus 10 remote attendees) and extremely well received. It was attended by representatives from the jewelry supply chain: Brilliant Earth, Diamond Development Initiative, Ethical Metalsmiths, International Colored Gemstone Association, Jewelers Vigilance Committee, Platinum Guild International, Responsible Jewellery Council, Richline Group (a Berkshire Hathaway company), Tiffany & Co.; and by government officials and NGO and academic professionals: US Dept. of State, US Dept. of Labor, World Bank/IFC, Pactworld, Chinese University of Geosciences and the Fundacao Gertulio Vargas (Sao Paulo, Brazil-based graduate school). (*MMS Faculty/Stakeholder Workshop Report and stakeholder letters of support attached in Annex*).

C. Transferability

1. Document any unique agreements concerning the transfer of students or credits.

Through the research fellowship of Dr. Saleem H. Ali, a partnership has been forged where UD's MMS program will offer the University of Queensland's Responsible Resource Development online graduate level courses not currently available through UD, as online electives as part of the MMS graduate certificate. Offering UQ's online classes allows us to leverage UQ's expertise, thereby attracting a more global student/professional base for the program. A partnership agreement has been drafted and is in the process of being reviewed and approved by all pertinent departments at UD including the departments of Graduate and Professional Education, Institute of Global Studies and legal counsel. UD will compensate UQ a portion of the cost of each credit hour taken by UD students, with the actual amount to be negotiated on an annual basis to reflect any changes in tuition. To demonstrate UQ's interest in this partnership while the agreement is being finalized, attached is a Letter of Intent to offer these courses to UD MMS students, as well as the draft agreement now being discussed and finalized by UD. (*UQ/UD Letters of Intent and Agreement attached in Annex*).

The University of Arizona (UofA) recently received funding to endow a Chair of Gem Sciences and will be offering undergraduate and graduate degree programs in gemology. We are pursuing a partnership with U of A so that the two programs can feed into each other. To that end we are jointly holding a special academic event at UofA in February titled "Minerals and Sustainable Development". UofA is also partnering with the Gemmological Association of Great Britain (Gem-A), a jewelry industry professional training organization, who is also interested in partnering with UD on content creation, field visits, etc. The CEO of Gem-A also expressed interest in partnering with the MMS program during an in-person meeting held with Professor Ali and Pat Syvrud on Oct. 8, 2018.

D. Access to graduate and professional programs

1. Please respond to this item only if the proposed course of study will prepare students for entry into graduate or professional schools. Describe briefly the requirements for admission into the appropriate graduate or professional program and the prospects for appropriate employment after completion of the advanced program.

This program will provide graduate level credits for students that have accredited transferability towards graduate degrees at a later date where program compatibility with a particular degree program exists. In particular, students who want to work on a Masters in Geography, Public Policy or related social science fields or a doctorate with topical connectivity would be able to use the graduate certificate as an important entry-level credential.

E. Demand and employment factors

1. Please respond to this item only if preparing students for specific employment opportunities is a key objective. In such cases, describe the audience and unique career paths.

Because this is a growing field, organizations are moving quickly to respond to the general public's demands for making ethical choices and working towards sustainability. In many cases, people are placing great importance on a corporation's reputation when it comes to their consumer choices. The field is still new enough that many businesses don't yet require entire corporate social responsibility divisions, though this is likely to change. Trends are expected to continue to emerge, and businesses will be adjusting their strategies accordingly. 'Corporate social responsibility specialist' is a new emerging field, so the global market for this category is completely unsaturated. The average *Risk Manager* salary in the United States is \$110,506.

Because of the significant management experience and educational background required to be a corporate social responsibility manager, this is often considered a senior level position, thereby justifying and necessitating the additional education through MMS. According to the U.S. Bureau of Labor Statistics (BLS), job growth for this occupation from 2014 to 2024 is expected to be a healthy 6+% in the short term.

For the extractives and mining industry professionals who will be attracted to this program, the US Department of Labor (DoL) and US BLS includes 15 different job titles related to mining with four types of jobs requiring higher degrees. The median salary for a Mineralogy professor is \$76,000 with a sector growth rate of 15%, which is much higher than average. Mining and Geological Engineers and Mining Safety Engineers average salary (in 2017) is \$94,240 per year with a sector growth rate of 8-9%.

Finally, according to MiningGlobal.com, 6 mining professions with a higher than expected salaries are:

1. Trade and Skilled - \$100,000 and up - Operators, technicians and miners fall under this category. Depending on the company and the region of work this number can change dramatically. Case in point: Jumbo operators in Australia earn roughly \$165k per year, while operators in other parts of the world only bring in \$111k.

2. Health and Safety - \$110,000 and up - The average annual salary of an environmental officer ranges between \$60,000 and \$115,000. A top-level occupational health and safety professional, however, will earn close to \$190k a year.

3. Metallurgist - \$220,000 and up - Metallurgist are one of the highest paid employees in the mining industry. A Graduate Metallurgist right out of the gate will earn between \$50,000 and \$90,000 per

year. Their ability to study the properties of metals and their knowledge of extraction, casting alloying and heating treatment of metals are music to an employer's ear. That's why salaries for the position range the \$220k and up category!

4. Geologist and Geosciences - \$200,000 and up - If you're looking to enter the mining industry as a Geologist there are typically two categories: Mine Geologist and Exploration Geologist. Both professions pay generously, and salaries range from \$90,000 to \$230,000 per year.

5. Engineers - \$230,000 and up - The mining industry may be experiencing tough times, but engineering salaries are flourishing. In fact, engineering positions rank the third highest paid jobs among the industry. Senior Engineers can expect to earn upwards of around \$230,000 per year.

6. Management - \$250,000 and up - Working as a General Manager, Project Controls Manager or Site General Manager will earn you a salary in the \$250,000 - \$350,000 per year range.

To reiterate Section B.1, Student Demand, in 2014, according to the McKinsey Global Institute, 43 percent of executives said their companies seek to align sustainability with their overall business goals, mission, or values, up from 30 percent in 2012. Additionally, in a 2015 article "Leading in a World of Resource Constraints and Extreme Weather," *Harvard Business Review* described three megatrends in corporate sustainability: resource constraints and rising commodity prices; climate change and extreme weather; and radical, technology-driven transparency, which are all issues that require new leadership and prompt the "rise of a Chief Sustainability Officer." Thus, the job outlook is excellent for mining and extractives specialists with sustainability skills.

F. Regional, state, and national factors

1. List comparable courses of study in the region or the State and explain why these existing programs cannot meet the needs of prospective students and/or employers in the geographic area which the curriculum would serve. Describe any significant differences between the proposed course of study and others in the region or State that have some similar characteristics.

While there various mining programs in United States, none has the same interdisciplinary approach proposed by the MMS program. As stated earlier, this program takes an interdisciplinary approach to linking science and policy around extractive supply chains, paired with multiple experiential learning modules. The closest program that exists in the world is The Centre for Social Responsibility in Mining (SMI-CSRM), Sustainable Minerals Institute, University of Queensland, Brisbane, Australia. <https://smi.uq.edu.au/csrm>. SMI-CSRM contributes to industry change through independent research, teaching and by convening and participating in multi-stakeholder dialogue processes. UQ's SMI offers a Masters in Responsible Resource Development which is offered as part online and part in-person courses and is partnering with UD to share the online content of this program with MMS students. (See Section G.2.)

Examples of other mining programs in the US are listed below, but all of them are quite different from the proposed MMS program. Thus, there is little to no competition to UD for students who want to build this unique skill set.

- University of Alaska, College of Engineering and Mines
<http://cem.uaf.edu/>
- University of Arizona, Mining and Geological Engineering
<https://mge.engineering.arizona.edu/>
- Colorado University, Colorado School of Mines;
<https://www.mines.edu/academics/#grad>
- Gemological Institute of America, Graduate Gemologist
<https://www.gia.edu/gem-education/program-graduate-gemologist>
- University of Kentucky, School of Mining Engineering
<https://www.engr.uky.edu/research-faculty/departments/mining-engineering>
- Montana Tech, School of Mines and Engineering
<https://www.mtech.edu/mines-engineering/>
- Missouri University of Science and Technology, Department of Mining Engineering
<http://mining.mst.edu/>
- Missouri University of Science and Technology, Department of Materials Science and Engineering: <https://mse.mst.edu/>
- University of Nevada, Mackay School of Earth Sciences and Engineering
<https://www.unr.edu/mackay>
- Pennsylvania State University, Department of Energy and Mineral Engineering
<https://www.eme.psu.edu/> and <https://www.eme.psu.edu/mnge>
- South Dakota School of Mines and Technology
<https://www.sdsmt.edu/>
- The University of Utah, Department of Mining Engineering
<http://www.mining.utah.edu/>

2. Describe the regional accrediting, professional association, and licensing requirements that have helped shape the proposed curriculum. Indicate the effects such agencies have had on the length, content or mode of delivery, and on such budgetary requirements as staffing levels, equipment needs, and facilities. Also, describe the participation of any non-campus person or organization in the development of this proposal. Report on timetables that have been established to meet any external requirements.

Helping to drive the creation of MMS at UD are several different mining/mineral/extractives industry initiatives which require supply chain auditing and certification to enable companies and countries comply with *Conflict Mineral* legislation in the US and EU, which is why one of the required MMS courses will be “Certification Systems for Sustainable Development.” Examples (not all-inclusive) of such mandatory and voluntary initiatives and standards helping to drive the MMS curriculum are:

- Responsible Jewellery Council’s supply chain certifications:
<https://www.responsiblejewellery.com/rjc-certification/>
- Fairmined gold certification: <http://www.fairmined.org/>
- Alliance for Responsible Mining CRAFT Code: <http://www.responsiblemines.org/en/our-work/standards-and-certification/craft/>

- Initiative for Responsible Mining Assurance: <https://responsiblemining.net/what-we-do/certification/>
- Organization of Economic and Cooperative Development Due Diligence Guidance for Responsible Supply Chain of Minerals from Conflict-Affected and High Risk Areas: <http://www.oecd.org/corporate/mne/mining.htm>
- Extractives Industry Transparency Initiative Global Standard: <https://eiti.org/who-we-are>
- Fair Trade certification: <https://www.fairtradecertified.org/business>
- United Nations Sustainable Development Goals: <https://sustainabledevelopment.un.org/sdgs>

Also involved with the development of the program is Helena Vladich, PhD, Senior Associate consultant to MMS. Helena is a member of the teaching faculty, Dept. of Environmental Sciences and Policy at Plymouth State University, NH, and a Research Fellow at the Gund Institute for Environment, Rubenstein School of Environment and Natural Resources at the University of Vermont. Helena developed the curriculum for one of the required courses for the graduate certificate, *Minerals and Ecological Economics*, and with the National University of Science and Technology MISIS located in Moscow, Russia, is creating one of the Experiential Learning Modules, *Innovations in Legacy Mining: Lessons from Russia's Iron Ore Anomaly*.

G. Describe other strengths

1. Describe any special features which convey the character or personality and make the proposed course of study distinctive. (Examples might include the interest and special expertise of certain faculty members, the location and availability of unique materials or technologies at or near the campus, special relationships to other departments, organizations, or institutions, etc.)

The program is being launched under the leadership of Dr. Saleem H. Ali, Blue and Gold Distinguished Professor of Energy and the Environment, and Dr. Neil Sturchio, Chair of the Department of Geological Sciences and participant in the Unidel Foundation grant to establish *Minerals, Materials and Society*. Dr. Ali is also leading a grant from the Tiffany & Co Foundation which established the *Gemstones and Sustainable Development Knowledge Hub (GemHub)*, an initiative that focuses on sustainable development in the gemstones sector: www.sustainablegemstones.org. The GemHub will be incorporated as one of the research arms of *Minerals, Materials and Society*. Professor Ali is also a Senior Fellow at the Columbia University Center on Sustainable Investment and Georgetown University's School of Foreign Service and a Professorial Research Fellow at the University of Queensland, Australia. He has been recognized for his leadership in forming collaborative programs between academia and industry by the World Economic Forum as a "Young Global Leader" and is also a member of the Global Future Council on Advanced Materials and the United Nations International Resources Panel.

Patricia Syvrud, Program Development Manager for MMS brings a wealth of knowledge and industry contacts from the jewelry industry and museum sector to UD. The immediate past Executive Director of the World Diamond Council, the international organization that represents the diamond supply chain at the United Nations-mandated Kimberly Process forum, Pat now sits on the Board of Directors of the United States Kimberley Process Authority and the mentorship committee of the Women's Jewelry Association. A GIA Graduate Gemologist who holds an MBA from the University of Southern California,

Pat had the unique experience of cataloging the National Gem Collection at the Smithsonian Institution in Washington, D.C. and serving as former Secretary of State Madeleine Albright's pro bono jewelry consultant to Albright's book and pin exhibit, "Read My Pins, Stories from a Diplomat's Jewel Box."

Pat is overseeing the development of the Jewelry Development Impact index (JDI) within the MMS program, along with Elizabeth Orlando, Special Advisor to the JDI and Foreign Service Officer in the Office of Threat Finance Countermeasures, US Department of State. JDI has already received commitments of support and assistance from the Natural Resource Governance Institute, the World Bank's International Finance Corporation's Disclosure 2 Development project and the Responsible Mining Foundation.

2. Report on any anticipated collaborative arrangements with other parties (for example, inter-institutional arrangements for resource sharing, cooperative programs, clinical affiliations, etc.). The extent of the relationship should be explained and instructional or other resources to be provided by the various parties described. Any written confirmation of the commitment, including drafts of contracts or agreements, should be attached.

As reported in section C.1., through the research fellowship of Dr. Saleem H. Ali, a partnership has been forged where UD's MMS program will offer the University of Queensland's Sustainable Minerals Institute's *Responsible Resource Development* online graduate level courses as electives of the MMS graduate certificate. Offering UQ's online classes allows us to leverage UQ's expertise, thereby attracting a more global student/professional base for the program. A partnership agreement has been drafted and is in the process of being reviewed and approved by all pertinent departments at UD including the departments of Graduate and Professional Education, Institute of Global Studies and legal counsel. UD will compensate UQ a portion of the cost of each credit hour taken by UD students, with the actual amount to be negotiated on an annual basis to reflect any changes in tuition. To demonstrate UQ's interest in this partnership while the agreement is being finalized, attached is a Letter of Intent to offer these courses to UD MMS students, as well as the draft agreement now being discussed and finalized by UD. (*UQ/UD Letters of Intent and Agreement attached in Annex*).

Dr. Helena Vladich is overseeing the creation of the Experiential Laboratory module *Innovations in Legacy Mining: Lessons from Russia's Iron Ore Anomaly Region*, which will be held in Russia through cooperation with the National University of Science and Technology MISIS located in Moscow, Russia. A *Memorandum of Understanding* drafted by NUST was reviewed and approved by Dan Bottomley and Trevor Nelson in UD's Institute of Global Studies department, as well as UD Associate Vice President and Deputy General Counsel Jennifer Becnel-Guzzo. The MoU needs only the parties' signatures to be finalized. (*MoU with National State Univ of Moscow attached in Annex*).

All incoming students into the MMS graduate certificate program will be required to take the United Nations Sustainable Development (UN SDG) Academy course titled *Natural Resources for Sustainable Development*: <https://www.edx.org/course/natural-resources-for-sustainable-development>.

UD is a member of the UN SDG Academy and has applied to, and been accepted into the SDG Academy's University Partnership Program. (*SDG Academy UPP acceptance letter and UD Letter of Support for the partnership signed by UD Provost Robin Morgan attached in Annex*)

III. ENROLLMENT, ADMISSIONS AND FINANCIAL AID

A. Enrollment

1. If enrollments are to be limited, e.g., by size, by pre-requisites, or by academic performance, describe the restrictions and the reasons for them. A letter of support from the Admissions Office for undergraduate programs or Office of Graduate Studies will also be helpful in projecting enrollments for the proposed program.

B. Admission Requirements

1. Describe the criteria for selecting among applicants.
2. Distinguish, if necessary, selection criteria between freshman, transfers from other institutions and transfers from within the University.
3. Attach any Retention Policy that might apply and provide rationale for this policy.

Admission to the graduate certificate program will have the same requirements as other UD Graduate Certificate programs, including the Graduate Certificate program application and UD minimum requirements for the TOEFL and IELTS for international candidates (see specific graduate certificate requirements below). An undergraduate degree will be expected for external candidates. We will also require enrollment and proof of completion and passing of a Massive Open Online Course (MOOC) which is offered by the United Nations Sustainable Development Academy titled *Natural Resources for Sustainable Development*. MMS candidates can offer this proof of completion after acceptance into the program but prior to course registration. (See Section G.2.)

Current UD undergraduate students will be able to enroll in the graduate certificate program in their senior year after completion of the UN SDG Academy MOOC. UD undergraduate and graduate students will be able to take MMS courses as electives with their advisor's permission. Currently enrolled UD students will register and pay for the MMS UQ online courses separately, should they wish to take them as electives. (See Section G.2.)

UD Graduate Certificate admission requirements:

1. Applicants must provide official transcripts showing the completion of a bachelor's degree from an accredited four-year college or university with a cumulative grade point average of 3.0 on a 4.0 scale (Applicants who are in the last semester of the bachelor's degree may apply and will be required to provide proof of the completion of the bachelor's degree prior to the first day of classes in the semester of admission);
2. International applicants must demonstrate a satisfactory level of proficiency in the English language if English is not their first language. The University requires an official TOEFL score of at least 550 on the paper-based test or 79 on the Internet-based test. TOEFL scores more than two years old cannot be considered official. Alternatively, IELTS can be accepted in the place of the TOEFL. The minimum IELTS score is 6.5 overall.
3. Applicants must include the certificate of completion and passing of the Massive Open Online Course (MOOC) that is offered by the United Nations Sustainable Development Academy titled *Natural Resources for Sustainable Development* in the admission application.
4. Names of two references should be supplied.
5. A resume outlining work and academic experience, as well as an application essay consisting of the following questions:

- a. What educational background and scientific research or employment experience prepare you for this certificate?
 - b. What are your professional objectives?
 - c. What specific attributes of the program make you feel that this certificate is appropriate to help you achieve your professional objectives?
6. Application deadlines: Admission decisions are made on a rolling basis and when the application is complete. The application deadlines are:
 - a. Fall semester: August-15 *Final deadline to apply*
 - b. Spring semester: January-23 *Final deadline to apply*
 - c. Summer: May-22 *Final deadline to apply*
 - d. Winter: December – 14 *Final deadline to apply*
 7. Students currently matriculated in other graduate programs on campus at the University of Delaware may be admitted to the Certificate program using the GRADUATE CERTIFICATE ENROLLMENT REQUEST FORM <https://www1.udel.edu/gradoffice/forms-new/gradcertificate-enrollment.pdf>
 8. The University of Delaware charges \$75 for the online admission application.
 9. Admission to *Minerals, Materials and Society* is selective and competitive, based on the number of well-qualified applicants and the limits of available faculty and facilities. Applicants who meet stated minimum academic requirements are not guaranteed admission, nor are those who fail to meet those requirements necessarily precluded from admission if they offer other appropriate strengths.

C. Student Expenses and Financial Aid

1. Indicate the need for any required student expenses beyond the traditional book and supplies, for example, personal computer, extensive laboratory fees, etc. For Graduate and professional courses of study, indicate anticipated levels of student financial support to be provided from (a) institutional and (b) other sources.

The program is designed to be revenue generating as graduate certificate and professional training programs. (See *MMS Business Plan attached in Annex*). Students can be supported for tuition by third party sources.

- International students and professionals will be able to attend on-campus courses with a 'J-1' visa, available to those studying for credit in a non-degree program. Students are required to spend a minimum of 21 days in the U.S. and be 50% funded by external entities such as institutional, private or governmental funders.
- In addition to normal graduate tuition for on-campus and online curricula, the MMS Experiential modules will necessitate additional travel fees, based on the per-person costs for each program.

With an estimated cost of average UD per credit graduate education cost for 15 credits, plus the additional cost for the MMS Experiential Labs, at an expected total per student total cost of US\$19,500*¹ the MMS program is still quite competitive with, and significantly less expensive than specialized programs such as the Gemological Institute of America's (GIA) programs. GIA's 2017 costs are estimated between \$32,953

¹ *Pending Per Credit Cost Approval by Office of Provost

and \$38,185, depending on the program: <https://www.gia.edu/gem-education/financial-aid-cost-attendance>. (Note: In 2016 GIA enrolled 162 Graduate Gemologists and had a 92.6% completion rate within 150% of the published program length: https://www.gia.edu/doc/2017_OC_SPFS_GraduateGemologist_FINAL.pdf)

IV. CURRICULUM AND ENROLLMENT SPECIFICS

A. Institutional Factors

1. State the degree to be awarded to those who complete the program and explain why this is the appropriate form of recognition.

Admission will take place on rolling basis with enrollment starting with first course taken after the program is initiated. The core educational offering will be a 15-credit graduate certificate program comprised of:

- Three required courses
- Elective options offered via online and on-campus delivery
- Experiential learning through a combination of field or lab-based coursework
- Two of the UD required courses will be delivered online during regular academic terms and the one UD required on-campus course will be offered in Winter or Summer terms. (one session only per term)
- The UD on-campus electives in this program will be offered in Winter or Summer terms. (one session only per term).
- Experiential modules will take place during UD's Winter or Summer terms. (one session only per term)
- UQ online elective courses will be taken during UQ regular academic terms, either Spring (beginning in February of each year) or Fall (beginning in July of each year). UQ functions within a 'semester' (not quarterly) system.

B. Describe the curriculum

1. Describe requirements involving total credit hours, credit hour distribution, field experiences, etc.
2. Indicate how the curriculum satisfies University of Delaware, college and departmental requirements, such as ENGL110, multicultural, college core, capstone, breadth, etc.
3. In the Appendices, provide approval letters from affected departments for all required courses that support the proposed curriculum (unless attached to APA).

The curriculum is as follows:

Non-Degree, 15 Credit Graduate Certificate in Minerals, Materials and Society

The program will be administered jointly by the Department of Geography in the College of Earth, Ocean and Environment and UD's Office of Graduate and Professional Studies, however the certificate will be offered by CEOE and CAS.

CORE REQUIRED COURSES			
REQUIRED ONLINE AND ON CAMPUS COURSES – 5 CREDITS			
College and Term	Program	Course Name	Credits
CEOE/UQ Online Spring or Fall	Geography/UQ	GEOG686 Sustainable Management of Risk in Industry	2
UD Online Spring or Fall	Geography	GEOG469/669 Minerals and Ecological Economics	2
CEOE On campus Winter or Summer	Geography	GEOG455/655 Certification Systems for Sustainable Development	1
REQUIRED EXPERIENTIAL LABORATORY MODULES – 2 CREDITS			
(Choose 1)			
CEOE - Travel study course in Russia – Summer Session. To start Summer 2020 Winter or Summer	Geography	GEOG484/684 Innovations in Legacy Mining: Lessons from Russia’s Iron Ore Anomaly Region	2
CEOE - Travel-study course in Australia Winter or Summer	Geography	GEOG465/665 Ecological and Social Restoration of Mineral Landscapes	2
CEOE - Lab based course at UD Minerals Museum Winter or Summer	Geology	GEOG613 Analytics of Minerals for Risk Management	2

ELECTIVE COURSES – 8 CREDITS			
(Choose from UD On-Campus Winter/Summer Terms Courses and/or UQ RRD Online Courses)			
UD ON-CAMPUS WINTER OR SUMMER TERMS (1 SESSION EACH ONLY) ELECTIVES			
College	Program	Course Name and Number	Credits
CAS	Anthropology	ANTH633 Anthropology of Mining in Africa	1
CAS	Anthropology	ANTH630 Anthropology of Development: Extractive Industry	1
CAS	Energy & Environmental Policy	EnEP624 Water Resource Management	1-2
CAS	Energy & Environmental Policy	ENEP635 Environmental Governance: Accountability and Transparency in Extractive Industries	1
CEOE	Geography	GEOG463/663 Environmental Impact of Deep-Sea Mining	2
CEOE	Geological Sciences	GEOL802 Topics in Geophysics: Minerals, Materials and Society: Conflict Diamonds	1
CEOE	Geological Sciences	GEOL802 Topics in Geophysics: Minerals, Materials and Society: Mineral Resources of Afghanistan	1

CEOE	Geological Sciences	GEOL612 Geology of Strategic Mineral Deposits Geologic occurrence of strategic mineral deposits and their global distribution	1
CEOE	Marine Science and Policy	MAST853: Oceanography Seminar - A review of current oceanographic literature through student presentations.	1 to 2 credits
CEOE	Marine Science and Policy	MAST 647 Current Topics in Chemical Methods in Oceanography	1 to 3 credits
CAS	Art History	ARTH 667 Art and Materiality in the Age of European Expansion, 1400-1800	1
EG	Materials Science & Engineering	MSEG 567 Materials for the Electronics Sector: Supply, Innovation and Impacts	1-2
CIEG	Civil & Environmental Engineering	CIEG 631 Industrial Ecology Methods: Life Cycle and Material Flow Analyses for a Circular Economy (1 cr.)	1
UQ'S SUSTAINABLE MINERALS INSTITUTE (SMI) RESPONSIBLE RESOURCE DEVELOPMENT ONLINE COURSES <i>Courses to be included as electives, pending partnership agreement approval now under discussion among appropriate UD departments (IGS, Graduate Studies).</i>			
College	Program	Course Name and Number	Credits
SMI	MMS	UQ Gemstones and Sustainable Development	1
SMI	RRD	UQENVM7100 Foundations of Sustainable Development	2

SMI	RRD	UQMGTS7976 Effective Stakeholder Engagement	2
SMI	RRD	UQMINE7023 Community Development for the Resources Sector	2
SMI	RRD	UQMINE7024 Community Engagement for the Resources Sector	2
SMI	RRD	UQMINE7052 Community Aspects in Resource Development	2
SMI	RRD	UQMINE7053 Sustainable Development in the Resources Sector	2
SMI	RRD	UQMINE7061 Sustainable Development in the Resources Sector - Tools and Integration	2
SMI	RRD	UQMINE7055 Regional and Local Economic Development in the Resources Sector	2
SMI	RRD	UQPOLS7101 Dynamics of Governance	2
UQX	MOOC	Future of Mining	* To be adapted by UD into a 1-2 credit online course that will be included in the curriculum as a Geography Special Topics course.

Sample Curriculum – 24 months or less

Semester/Session	Possible Courses	Required or Elective	Number of Credits
Spring Semester 2020	GEOG686 - Sustainable Management of Risk in Industry	Required (Online)	2
	GEOG669 – Minerals and Ecological Economics	Required (Online)	2

	UQMINE7053 - Sustainable Development in the Resources Sector (or others listed in Matrix)	Elective (Online)	2
Summer Session 2020	GEOG684 - Experiential Laboratory in Russia Innovations in Legacy Mining OR GEOL613 Analytics of Minerals for Risk Management	Required (Experiential Field course)	2
Fall Semester 2020	UQMINE7061 - Sustainable Development in the Resources Sector – Tools and Integration	Elective (Online)	2
	UQMINE7023 - Community Development for the Resources Sector	Elective (Online)	2
Winter Session 2020	GEOG655 – Certification Systems in the Extractive Industries	Required (On campus)	1
Any UD courses listed in matrix above	Examples: MSEG 567 Materials for the Electronics Sector GEOL612 Geology of Strategic Mineral Deposits ENEP667 Environmental Governance: Accountability and Transparency in Extractive Industries	Elective (On campus)	2-6
Spring Session 2021 (Any 2-3 UQ online courses in matrix above)	Examples: UQPOLS7101 Dynamics of Governance UQMINE7052 Community Aspects in Resource Development UQMGTS7976 Effective Stakeholder Engagement	Elective (Online)	1 - 6
TOTAL CREDITS EARNED			15-19 CREDITS

Approval letters from the Chairs of all affected UD departments are attached. All endorse the creation of this graduate certificate program and have approved faculty to teach the on-campus courses during either UD's Winter or Summer sessions. (*List of UD teaching faculty for offered courses attached in Annex*).

V. RESOURCES AVAILABLE

A. Learning Resources

1. Describe briefly the scope and quality of available library holdings, audio-visual materials, special equipment and collections, laboratories, clinical facilities, research facilities, etc., that are available and would directly support the proposed course of study. If appropriate, obtain a Library Assessment Statement. **This section is not required if a letter of support from the library was attached to the APA.** (*Report on Library Services in Support of MMS from the Vice Provost for Libraries and Museums attached in Annex*)

2. Library Assessment Statement: A formal written assessment from the Director of Libraries of the Library's ability to support a proposal for a new or expanded academic degree or

program is required as part of a formal proposal. The assessment statement may include but is not limited to the strength of collections; access to electronic and networked information access to collections not owned by the University of Delaware; library space and library computer requirements; language and subject capabilities of library staff; and nature of service and increased usage demands resulting from the proposed new degree/program. The request for the library assessment accompanied by details of a proposed degree or program needs to be received by the Library at least one month before the Library's assessment of a proposed degree or program is required. The Library will respond in a timely manner, usually within two weeks in order to allow time for faculty discussion of the library assessment and possible further discussion and/or interaction with the Director of Libraries, if desired.

B. Faculty / Administrative Resources

1. Describe the available program administrators and faculty expertise which support the proposed curriculum. List name, rank, specialization, nature of appointment (regular, full-time, adjunct, etc.) and highest academic degree earned by those who would be directly involved, including campus administrators. If appropriate, provide pertinent information about the professional and scholarly accomplishments, including training, courses and workshops taught, publications and projects, and other relevant documentation of the faculty.

Faculty from the Departments of Anthropology, Art History, Energy and Environmental Policy, Geography, Geology, Marine Science and Policy and Materials Science and Engineering have all committed to teaching the courses in the offered Winter and Summer sessions. (*List of UD teaching faculty for offered courses attached in Annex*) As mentioned in Section G.1., Pat Syvrud has been hired as full-time Program Development Manager for MMS to help bring the entire program to fruition and is funded through the Unidel Foundation grant until September 2019. Professor Ali, Ms. Syvrud and multiple representatives from UD's University Development Department are already actively fundraising to support the MMS management and faculty positions needed after the Unidel Foundation grant is concluded. S-contract positions for particular teaching assignments such as the *Minerals and Ecological Economics* course would be resourced through tuition revenue generated for that course.

Prior to launching MMS, a Program Director will be hired to oversee the multiple facets of the program, including program marketing for the graduate certificate program, experiential laboratories and future professional training modules; program and fundraising website management; ongoing fundraising and building a program endowment (with UD's Development Office); ongoing course development and affiliated research projects.

This program director will also organize and lead any program related meetings and events and serve as the initial point of contact for any interested UD students and prospective professional students and organizations. Semi-annual meetings will be scheduled to maintain the interdisciplinary engagement of the different colleges on campus and discussions will be held to review current and future course material and enact action plans to enhance the program as it grows. The program director will report to the Dean of the College of Earth Ocean and Environment, and any program changes will be decided by the Program Director and Chair of the Department of Geography, with the input of and in consultation with all pertinent affiliated UD faculty.

C. External Funding

1. Indicate any resource or source of funding external to the University which has been garnered to support the curriculum.

Fundraising efforts to build an endowment to ensure the sustainability of the program are well under way. Representatives from UD's Development Office responsible for Corporate and Foundation giving, Professor Ali and Ms. Syvrud have already engaged in person and on the phone with foundations and industry prospects from multiple related sectors and have garnered interest for support from several entities. A proposal is currently in development for financial support from the Richline Group, a Berkshire Hathaway company, and an expression of interest in funding professional training has been made verbally by multiple international development organizations. A crowdfunding web site is under development and set to launch prior to year's end.

VI. RESOURCES REQUIRED

A. Learning Resources

1. Identify needed additional learning resources. Indicate which of these are essential for basic implementation and whose which will produce a premiere program able to compete favorably for the highest caliber of student.

Additional learning resources necessary to the success of the program have been outlined in Section 2. G.2 and IV.B.

B. Personnel Resources

1. Indicate any new faculty positions required and the qualifications and subject matter specialties that will be sought. Give reasons for needing new position.

S-Contract faculty will be hired according to specific specialized course needs and resourced through tuition revenue for those courses. As mentioned above, a Program Director would preferably be hired prior to the launch of MMS to oversee the program, as detailed in Section V.B. Fundraising for this role is underway through the efforts of the UD Development Office.

C. Budgetary Needs

1. Attach an accounting of budgetary needs.

Please see the *Minerals, Materials and Society* Business Plan attached in Annex, which includes estimated revenues and expenses.

VII. IMPLEMENTATION AND EVALUATION

A. Implementation Plan

1. Describe how the curriculum will be implemented.

The curriculum will be implemented through the approved coursework already noted and where appropriate through transfer credit arrangements with University of Queensland in Australia for their online course offerings. We have established a university-wide governance committee for the program (comprising members of the existing planning committee). This committee will oversee the implementation of the curriculum and also assist with student recruitment.

B. Assessment Plan

1. Indicate how the program will be evaluated and assessed. Some measures should be quantitative, other qualitative. Success should be measured against the criteria listed including stated learning outcomes and against whatever objectives have been set forth in the first section of the proposal. Academic units are encouraged to consult with the Center for Teaching and Assessment of Learning in developing the appropriate learning outcomes, assessment criteria, and benchmarks for success.

The program will follow the policies and procedures and academic program review schedule as established by the office of Graduate and Professional Education and by the Office of the Provost and Faculty Senate. Assessment best practice will be followed like that for other programs in the College of Earth Ocean and Environment.

Assessment data will be collected from the Office of Institutional Research and Effectiveness in tandem with faculty and student interviews, alumni interviews and other measures of scholarly achievement. The Program will regularly consult with the Center for Teaching and Learning to assess learning outcomes, assessment criteria, and benchmarks for student success. The assessment plan for the student learning outcomes is based on Learning Outcomes, listed in Part I.

This section clearly defines the criteria for learning goals in MMS program. This section also lists the learning outcomes/goals and courses to be assessed and the direct evidence (DE)* and indirect evidence (IE) ** that will be employed to determine whether students have achieved the learning goals. As there are no standardized tests in this field of study, nor external accreditation institution from which to establish benchmarks for assessments, reasonable internal assessment standards have been developed. For each criterion, there is definition on what would be excellent, very good/good, adequate, and inadequate work.

*DE = exams, in-class surveys, discussions, projects, manuscripts

**IE = course evaluations

Learning Goal #1	Gain a systems analysis perspective of the mining/extractives industry complexities, impacts, risks and interdependencies.	Courses assessed: GEOG469/669, GEOG686, GEOG 484/684, GEOG465/665, GEOL613, GEOL802 (Both), ANTH630, ANTH633, MAST853, MSEG567
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Learning Goal #2	Analytical skills - to analyze information and evaluate results to choose the best solution and solve problems; to consider relative costs and benefits of potential actions to drive conscientious decision making.	Courses assessed: GEOG 469/669, GEOG455/655, GEOG686, GEOG465/665, GEOG484/684, GEOG487/687, GEOL613, EnEP624, EnEP635, MAST853
Learning Goal #3	Understand the salience of social and environmental issues and how to minimize risk of conflicts to their businesses, and society and ecology.	Courses assessed: GEOG469/669, GEOG686, GEOG465/665, GEOG484/684, GEOL613, ANTH630, ANTH633, ARTH667, MAST647, MSEG567
Learning Goal #4	Learn innovative tools and techniques that promote successful and sustainable mining operation development and supply chain management.	Courses assessed: GEOG469/669, GEOG465/665, GEOG484/684, GEOL613, GEOG487/687, EnEP624, EnEP635, MAST647, MSEG567
Learning Goal #5	Familiarity with global responsible sourcing, sustainability initiatives	Courses assessed: GEOG455/655, GEOG686, GEOG465/665, GEOL612, GEOL613, GEOL 802 (Both), MAST853, MSEG567
Learning Goal #6	Understanding successful socio-environmental and supply chain audits and certification	Courses assessed: GEOG455/655, GEOL802 (Both), EnEP624

Criteria	Excellent (A)	Very Good (A-B+)	Adequate (B/B-/C+)	Inadequate (<C+)
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DE Exams	Mastery of course content at the highest level of attainment that can reasonably be expected of students at a given stage of development.	Strong performance demonstrating a high level of attainment for a student at a given stage of development.	A totally acceptable performance demonstrating an adequate level of attainment for a student at a given stage of development.	A marginal performance in the required exercises demonstrating a minimal passing level of attainment, or for whatever reason, an unacceptable performance
DE: discussions, manuscripts	A very well structured and articulated argument that is backed by sufficient, well selected and well-analyzed evidence from the appropriate literature and field and laboratory findings	A structured and articulated argument that is backed with some well-selected and analyzed evidence from the literature and field findings	A serious attempt at an argument backed with mediocre evidence and some effort to incorporate evidence from the literature and field study	A less than serious attempt at an argument backed with inadequate and/or inappropriate evidence from outside sources (the literature and field study)
DE: effectively manage projects workflow	Excellent work progress, effective multi-tasking, crystal-clear productivity log and notes to replicate	Very good work progress, effective multi-tasking, mostly clear productivity log and notes to replicate	Solid work progress, effective multitasking, much of the time clear productivity log and notes to replicate	Inefficient work progress, ineffective multi-tasking, unclear productivity log and note to replicate

- VIII. APPENDICES (as appropriate and if not submitted with APA)
- A. Accreditation Criteria (if appropriate)
 - B. Letters of Collaborative Agreement
 - C. Transfer / Retention Policy
 - D. Letters of Approval from Contributing Departments
 - E. Other Pertinent Documents