



UNIVERSITY OF MARYLAND EASTERN SHORE  
*Office of the President*

July 15, 2022

James D. Fielder, Jr., Ph.D.  
Secretary of Higher Education  
Maryland Higher Education Commission  
6 N. Liberty St, 10<sup>th</sup> Floor  
Baltimore, MD 21201

Dear Secretary Fielder:

The University of Maryland Eastern Shore hereby submits a substantial change proposal to begin offering an **MS in Data Science and Analytics Engineering (MSDSAE)**.

Consistent with its mission, UMES seeks to expand its capacity to offer unique and/or critical certificate and degree programs. As such, UMES, with the financial and technical assistance of the Microsoft Corporation, has developed an MS in Data Science and Analytics Engineering (MSDSAE). This new program complements the university's undergraduate programs in Computer Science, Engineering with specializations in Electrical and Computer, and Business, which offers Bachelor's Degrees in Accounting, Business Administration, Finance, and Marketing with elements of data analytics embedded throughout their curricula. Furthermore, the proposed MSDSAE will also complement the existing Master of Applied Computer Science and Master of Science in Cybersecurity Engineering Technology Programs within the School of Business and Technology.

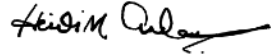
The proposed degree program will also improve UMES's position at the forefront of emerging research in critical areas of precision agriculture, natural sciences, and pharmaceutical science. The existing undergraduate engineering program at UMES has continuously supplied undergraduate researchers to assist in research projects conducted by faculty members in agriculture, physics, and pharmaceutical science with their skills and knowledge in the engineering discipline. The proposed MSDSAE is expected to enable stronger and more multi-disciplinary research collaboration across the campus community, thus fueling research across the campus.

The MSDSAE would serve both non-traditional and traditional students who are interested in the data analytics engineering field. The mission of the proposed program is to provide students and working professionals with advanced training in the disciplines of data science and analytics engineering; to promote innovation and technology development in the emerging field of accounting analytics, aviation safety, machine learning, spatial technology, financial engineering, for UMES research enterprise; and to contribute to the economic development in the state of Maryland, especially in the Eastern Shore region where learning opportunities in advanced engineering disciplines is severely limited.

The attached proposal has undergone the established UMES curriculum approval process and I fully support the proposed program.

Thank you for considering this request.

Sincerely,



Heidi M. Anderson, Ph.D., FAPhA  
President

Copy: Dr. Rondall Allen, Provost and Vice President for Academic Affairs  
Dr. Brian K. Bergen-Aurand, Interim Vice Provost  
Dr. Derrek Dunn, Dean, School of Business and Technology



**Cover Sheet for In-State Institutions**  
**New Program or Substantial Modification to Existing Program**

Institution Submitting Proposal	University of Maryland Eastern Shore
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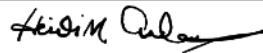
*Each action below requires a separate proposal and cover sheet.*

- |   |   |
|---|---|
| <input checked="" type="radio"/> New Academic Program | <input type="radio"/> Substantial Change to a Degree Program            |
| <input type="radio"/> New Area of Concentration       | <input type="radio"/> Substantial Change to an Area of Concentration    |
| <input type="radio"/> New Degree Level Approval       | <input type="radio"/> Substantial Change to a Certificate Program       |
| <input type="radio"/> New Stand-Alone Certificate     | <input type="radio"/> Cooperative Degree Program                        |
| <input type="radio"/> Off Campus Program              | <input type="radio"/> Offer Program at Regional Higher Education Center |

Payment <input checked="" type="radio"/> Yes	Payment <input type="radio"/> R*STARS #	Payment	Date
Submitted: <input type="radio"/> No	Type: <input type="radio"/> Check #	Amount:	Submitted:

Department Proposing Program	School of Business and Technology		
Degree Level and Degree Type	Master of Science		
Title of Proposed Program	Data Science and Analytics Engineering		
Total Number of Credits	36		
Suggested Codes	HEGIS: 799.00	CIP: 119999.0000	
Program Modality	<input checked="" type="radio"/> On-campus	<input checked="" type="radio"/> Distance Education ( <i>fully online</i> )	
Program Resources	<input checked="" type="radio"/> Using Existing Resources	<input type="radio"/> Requiring New Resources	
Projected Implementation Date	<input checked="" type="radio"/> Fall	<input type="radio"/> Spring	<input type="radio"/> Summer Year: 2023
Provide Link to Most Recent Academic Catalog	URL: <a href="http://catalog.umes.edu/index.php">http://catalog.umes.edu/index.php</a>		

Preferred Contact for this Proposal	Name:	Brian Bergen-Aurand, PhD
	Title:	Interim Vice Provost for Instructional Planning and Quality
	Phone:	(410) 651-6713
	Email:	<a href="mailto:bkbergenaurand@umes.edu">bkbergenaurand@umes.edu</a>

President/Chief Executive	Type Name:	Heidi M Anderson
	Signature:	 Date: 07 / 15 / 2022

	Date of Approval/Endorsement by Governing Board:
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Revised 1/2021

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## **Proposal for New Graduate Degree Program**

### **Master of Science in Data Science and Analytics Engineering (MSDSAE)**

#### **Proposal Executive Summary**

The School of Business and Technology at the University of Maryland Eastern Shore (UMES) proposes to establish a **Master of Science in Data Science and Analytics Engineering (MSDSAE)** degree at the University of Maryland Eastern Shore (UMES). The MSDSAE aims to offer prospective students a graduate program with strong foundations in theory and practice to meet the needs of technical professionals including those in the Eastern Shore of Maryland with more advanced learning in a specialized discipline of data science and analytics. The program, if approved, will help students develop new technologies in the emerging fields of data science for a wide range of applications including agriculture, automotive, aerospace, clean energy systems, construction, finance, healthcare, and hospitality management. It will also prepare them, especially those with disadvantaged backgrounds, with the knowledge and tools necessary to take on engineering leadership roles to shape the future of technology advancement.

The MSDSAE program will be interdisciplinary in nature and involve faculty from the following departments:

- Business, Management, and Accounting (BMA),
- Computer Science and Engineering Technology (CSET),
- Engineering and Aviation Sciences (EAVS),
- Hospitality and Tourism Management (HTM), and
- the Built Environment (BE).

A council of faculty selected from BMA, CSET, HTM, BE, and EAVS will oversee the program's operation, curriculum, and admissions.

## **A. Centrality to Institutional Mission and Planning Priorities**

### ***1. Provide a description of the program, including each area of concentration (if applicable), and how it relates to the institution's approved mission.***

The proposed Master of Science in Data Science and Analytics Engineering (MSDSAE) degree program consists of a thesis option (30 credits), a project option (33 credits), and a coursework-only option (36 credits). The mission of the MSDSAE program is to provide students or working professionals with an advanced leaning in the discipline of data science and analytics engineering: to promote innovation and technology development in the emerging field of accounting analytics, aviation safety, machine learning, spatial technology, financial engineering, for UMES research enterprise; and to contribute to the economic development in the State of Maryland, especially in the Eastern Shore region where learning opportunities in advanced engineering disciplines is severely lacking.

The objective of the proposed degree program aligns with the mission of UMES. The UMES's mission statement states "University of Maryland Eastern Shore (UMES), the State's Historically Black 1890 Land-Grant institution, emphasizes baccalaureate and graduate programs in the liberal arts ... In keeping with its land-grant mandate, the University's purpose and uniqueness are grounded in distinctive learning, discovery, and engagement opportunities in agriculture, marine and environmental sciences, technology, engineering, and aviation sciences, health professions, and hospitality management. Degrees are offered at the bachelors, masters and doctoral levels." The establishment of the MSDSAE program at UMES will aid it in fulfilling the mission of UMES as a historically black, 1890 land-grant institution and serves to support the university goal of maintaining its Carnegie Research University classification.

### ***2. Explain how the proposed program supports the institution's strategic goals and provide evidence that affirms it is an institutional priority.***

Consistent with its mission, UMES seeks to expand its capacity to offer unique and/or critical certificate and degree programs. As such, the University has been working towards the development of a master's program in Data Science and Analytics Engineering to complement its undergraduate programs in Hospitality and Tourism Management, Engineering Technology with a concentration in Electrical/Electronic Engineering Technology, Computer Science, Engineering with specializations in Electrical and Computer, and a Business program which offers Bachelor's Degrees in Accounting, Business Administration, Finance, and Marketing, with elements of data analytics embedded throughout their curricula.

The proposed graduate program supports the institution's strategic goals. According to the UMES Strategic Plan (<https://wwwcp.umes.edu/president/strategic-plan/>), the proposed graduate program will support the following goals:

- *Goal III: Become a leading USM partner in research, innovation, and economic competitiveness*, Sub-Goal 3.1 Increase innovation in academic programs and delivery methods and 3.2 Align academic programs, educational centers, and enterprises, and co-curricular activities with workforce development needs;
- *Goal IV: Meet the educational needs of the state of Maryland with high-quality and innovative academic programming*, Sub-Goal 4.1 Align academic programs with the educational needs of the state of Maryland; and
- *Goal VI: Achieve and Maintain National Eminence and Global Impact*, Sub-Goal 6.1 Create signature academic programs to prepare students for careers nationally and internationally and 6.5 Compete for national recognition of academic programs.

The proposed degree program will substantially help the institution achieve its strategic goals listed above and position UMES at the forefront of emerging research in critical areas of precision agriculture, construction, and computer science. In the past years, the existing undergraduate engineering program at UMES has continuously supplied undergraduate researchers to assist in research projects conducted by faculty members in agriculture, physics, and pharmaceutical science with their skills and knowledge in the engineering discipline. The proposed MSDSA E program is expected to enable stronger and multi-disciplinary research collaboration across the campus community, thus fueling research forward in many other different disciplines beyond engineering, and creating a much broader impact on the entire campus community.

***3. Provide a brief narrative of how the proposed program will be adequately funded for at least the first five years of program implementation. (Additional related information is required in section L.***

On April 2, 2021, Microsoft Corporation awarded UMES a \$100,000 cash donation to assist with the development and implementation of the MSDSA E program. Additionally on March 2, 2022, Microsoft awarded UMES another cash gift of \$75,000 for which some of those funds will be supporting the development of aviation and cybersecurity related courses for the MSDSA E program.

The previously mentioned funds will be used to support faculty development and the teaching of the MSDSA E courses. In addition, the School of Business and Technology will reallocate one current full-time faculty position to also support the proposed program. After the expenditure of the Microsoft funds, the program is expected to be self-sustaining going forward beyond the first five years of the program's existence. Lastly, as an interdisciplinary program, it will draw faculty as needed from the following departments: Business, Management and Accounting (BMA), Computer Science and Engineering Technology (CSET), Engineering and Aviation Sciences (EAVS), Hospitality and Tourism Management (HTM), and the Built Environment (BE).

***4. Provide a description of the institution's commitment to:***

- a) ongoing administrative, financial, and technical support of the proposed program***

This degree program is created by leveraging, in part, the existing faculty and staff in the Department of Business, Management and Accounting, Department of Computer Science and Engineering Technology, Department of Engineering and Aviation Sciences, Department of Hospitality and Tourism Management, and Department of the Built Environment at UMES. The internal approval procedure for programmatic modification is indicative of UMES' commitment to ongoing administrative, financial, and technical support of the proposed program. The proposed master's program in Data Science and Analytics Engineering has been vetted by the faculty in the School of Business and Technology, the school Dean, Faculty Assembly Curriculum Committee, UMES Faculty Assembly (institution-wide shared governance body), the Provost and Vice President for Academic Affairs, as well as UMES President - indicating that the proposed program has been affirmed by the institution. Technical support from UMES Information Technology has been ongoing for several decades and no change is expected in the established processes for the proposed academic programs needing IT support.

***b) continuation of the program for a period of time sufficient to allow enrolled students to complete the program.***

UMES is committed to support the program with sufficient time for enrolled students to complete the Master of Science in Data Science and Analytics Engineering degree. To satisfactorily achieve strategic goals and maintain quality and excellence, the continuous support of the Data Science and Analytics Engineering program (e.g., students and candidates) through graduation, is essential to the UMES mission and goals.

## **B. Critical and Compelling Regional or Statewide Need as Identified in the State Plan**

***1. Demonstrate demand and need for the program in terms of meeting present and future needs of the region and the State in general based on one or more of the following:***

***a) The need for the advancement and evolution of knowledge***

The field of data science has existed for over thirty (30) years, but due to advances in technology and large data sets being generated due to advances in computational power of computing devices, the field of data science has gained increased importance to human society. Data science as a field is interdisciplinary in nature and can be applied to many applications in such fields as construction, image analysis, data processing, geoprocessing and tracking, predictive systems, mobile technology, finance, and health care to name a few.

One recent example of the application of data science in the healthcare field is in the development of the COVID-19 vaccines. According to Kose (2021), the application of data science to access information being generated by the modeling of test vaccines (i.e., the COVID-19 virus before and post-human trials) was key to the quick development of the eventual COVID-19 vaccines, which are now in use around the world.

***b) Societal needs, including expanding educational opportunities and choices for minority and educationally disadvantaged students at institutions of higher education***



UMES is located in Maryland's Somerset County, which is among the poorest counties in the state according to the United States Census Bureau (<https://www.census.gov/quickfacts/somersetcountymaryland>). UMES offers the only undergraduate engineering degree program on the Eastern Shore of Maryland and there is a strong demand for a graduate education in engineering in the region. As such, offering the proposed master's degree program is critical to the needs of the local economy.

The need for a graduate program in Data Science and Analytics Engineering on the Eastern Shore region will allow students in STEM majors at other regional institutions to enroll in the graduate program and hence serve the societal and economic needs of the Eastern Shore of Maryland in particular and the State of Maryland in general.

***c) The need to strengthen and expand the capacity of historically black institutions to provide high quality and unique educational programs***

UMES offers the only engineering bachelor's degree program on the Eastern Shore of Maryland. The proposed master's program in Data Science and Analytics Engineering will significantly strengthen and expand the capability of UMES, one of the four HBIs in the state, to provide high-quality and unique educational experiences to students.

***2. Provide evidence that the perceived need is consistent with the Maryland State Plan for Postsecondary Education.***

The proposed master's degree program is well aligned with the 2017-2021 Maryland State Plan for Postsecondary Education in all three areas: Access, Success, and Innovation.

**Access – Ensure equitable access to affordable and quality postsecondary education for all Maryland residents.**

The master's degree program is intended to prepare highly trained data scientists and analytic engineers at the graduate level in the areas of construction, image analysis and data processing, geoprocessing, and tracking, predictive systems, mobile technology, finance, and healthcare, which are becoming increasingly important and relevant to our society. However, graduate education can present barriers for students to access. The proposed graduate degree program will provide equitable access and quality education to all Maryland residents, including those with disadvantaged backgrounds, to develop a strong data scientist and analytic engineering workforce for the state.

**Success – Promote and implement practices and policies that will ensure student success.**

The practices and policies concerning the proposed master's degree program align with all existing policies at the University, which will ensure student success. By providing a carefully developed curriculum, sufficient laboratory facilities, equipment, and adequate faculty members for advising and teaching, the proposed degree program will help ensure student graduation and successful job placement.

**Innovation – Foster innovation in all aspects of Maryland higher education to improve access and student success**

Specifically, the proposed master’s degree program aligns with the goal of *Innovation* of the State Plan, which aims to *foster innovation in all aspects of Maryland higher education to improve access and student success*. The proposed program will help achieve the goal of *Economic Growth and Vitality*, which is centered on supporting a knowledge-based economy through increased education and training. The proposed approach is to ensure that Historically Black Institutions (HBIs) are *competitive, both in terms of programs and infrastructure*, with Maryland’s other state institutions. Ultimately, the proposed degree program will prepare highly qualified data scientists and engineers to contribute to the economic growth and vitality of Maryland, by providing them with new knowledge and skill sets in emerging technologies, so they can maintain the skills they need to succeed in the workforce.

**C. Quantifiable and Reliable Evidence and Documentation of Market Supply and Demand in the Region and State**

**1. Describe potential industry or industries, employment opportunities, and expected level of entry (ex: mid-level management) for graduates of the proposed program.**

It is anticipated that corporations such as Lockheed Martin, Boeing, Northrop Grumman Corporation, as well as government sectors such as NASA, US Navy, US Army would have a strong interest in hiring graduates of the proposed program. By leveraging UMES School of Business and Technology affiliation with the Advancing Minorities' Interest in Engineering (AMIE) and its corporate partners, it is expected that graduates of the proposed master’s degree program will secure mid-level technical and management jobs in industry and the government sectors, where data science and engineering workforce is highly sought.

Our current graduates of the academic programs in the School of Business and Technology are working for various companies from small to large, including Microsoft, General Electric, Amazon, to name a few. Some are working for government sectors such as NASA, and the Department of Defense. Graduates with bachelor’s degrees normally start with entry-level positions, while graduates with master’s degrees normally start with mid-level positions.

**2. Present data and analysis projecting market demand and the availability of openings in a job market to be served by the new program.**

<b>Job Title</b>	<b># of Maryland Positions (2018)</b>	<b># of Maryland Positions (2028)</b>	<b>Percentage Growth</b>
Computer and Mathematical Occupations	113,209	130,011	14.84%
Database Administrators	2,913	3,312	13.7%

Source: <http://www.dllr.state.md.us/lmi/iandoproj/maryland.shtml> (accessed February 22, 2022).

<b>Job Title</b>	<b># of Positions (2020)</b>	<b># of Positions (2030)</b>	<b>Percentage Growth</b>
Data Processing Systems Analysts	607,800	650,600	7%

Source: <https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm> (accessed February 22, 2022).

***3. Discuss and provide evidence of market surveys that clearly provide quantifiable and reliable data on the educational and training needs and the anticipated number of vacancies expected over the next 5 years.***

The Maryland Department of Labor Licensing and Regulation (DLLR) website does not have a specific job category for data science and analytics engineering. However, there is an umbrella category of Computer and Information Research Scientists which is representative of the field. Therefore, according to the Maryland Department of Labor Licensing and Regulation (DLLR) website, there is a current need of over 2,700 positions in the State of Maryland for a person with the educational background, i.e. graduate degree, to fill positions related to Computer and Information Research Scientist.

<b>Job Title</b>	<b># of Maryland Positions (2018)</b>	<b># of Maryland Positions (2028)</b>	<b>Percentage Growth</b>
Computer and Information Research Scientists	2,794	3,168	13.3%

Source: <http://www.dllr.state.md.us/lmi/iandoproj/maryland.shtml> (accessed February 17, 2022).

Also, the United States Bureau of Labor Statistics (USBLS) website does not have a specific job category for data science and analytics engineering. However, there is an umbrella category of Computer and Information Research Scientists which is representative of the field. Therefore, according to the United States Bureau of Labor Statistics (USBLS) website, there is a current need for 33,000 positions nationally for persons with an education background, i.e. graduate degree, to fill positions related to Computer and Information Research Science. The median salary for an individual who is properly credentialed in the field is estimated to be \$126,830 according to the USBLS.

<b>Job Title</b>	<b># of Positions (2020)</b>	<b># of Positions (2030)</b>	<b>Percentage Growth</b>
Computer and Information Research Scientists	33,000	40,200	22%

Source: <https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm> (accessed February 17, 2022).

***4. Provide data showing the current and projected supply of prospective graduates.***

The number of graduates from the current Bachelor of Science in Accounting (BSA), Bachelor of Science in Business Administration (BSBA), Bachelor of Science in Computer Science (BSCS),

Bachelor of Science in Engineering (BSE), Bachelor of Science in Hos, Bachelor of Science in Finance (BSF), Bachelor of Science in Marketing (BSM), at UMES is summarized as follows:

<b>Program</b>	<b>2014-2015</b>	<b>2015-2016</b>	<b>2016-2017</b>	<b>2017-2018</b>	<b>2018-2019</b>	<b>2019-2020*</b>
BSA	15	15	15	15	15	14
BSBA	46	38	27	27	20	20
BSCS	17	15	11	18	23	22
BSE	14	11	11	7	22	19
BSHTM	34	39	33	44	22	26
BSF	2	2	8	5	4	8
BSM	-	-	2	8	7	14
<b>Total</b>	<b>128</b>	<b>120</b>	<b>107</b>	<b>124</b>	<b>113</b>	<b>123</b>

Based on the above number of graduates who will be eligible to enroll in the proposed master’s degree, the projected supply of prospective graduates from UMES feeder programs are estimated to be ten (10) in the first year with a projection of ten (10) new students per year for the initial five years of the program’s operation.

In addition to the United States Bureau of Labor Statistics, a project led effort with the University of Maryland Eastern Shore’s faculty and students was considered to determine the implementation of learning techniques in the School of Business and Technology, Department of Engineering and Aviation Sciences as it relates to data analytics. The Institutional Review Board (IRB) at UMES had approved research protocols for studies that involved student-led research with faculty about student effectiveness using data analytics techniques for further advancement in STEM education and program development regarding interdisciplinary study. The IRB protocol number (11-2019-EXEMPT-007) review by the institution allowed the survey to be rendered about how the use of data analytics and methods to specific practices (e.g., safety management systems) can be examined to improve engineering and aviation sciences. From the course findings, learners were able to determine that data analytics concepts regarding safety management systems in engineering and aviation education. The learners had determined that the overall satisfaction and effectiveness using data analytics concepts as undergraduate students had allowed them to promote engineering and aviation practices using proposed industry features for database management and statistical evaluation. The figures below are used to highlight how the implementation and new programs associated with specific data analytics concepts can potentially advance student interest from an interdisciplinary approach in engineering and aviation education.

Undergraduate Learners at the University of Maryland Eastern Shore, Capstone Course: How satisfied are you with safety management systems implementation?

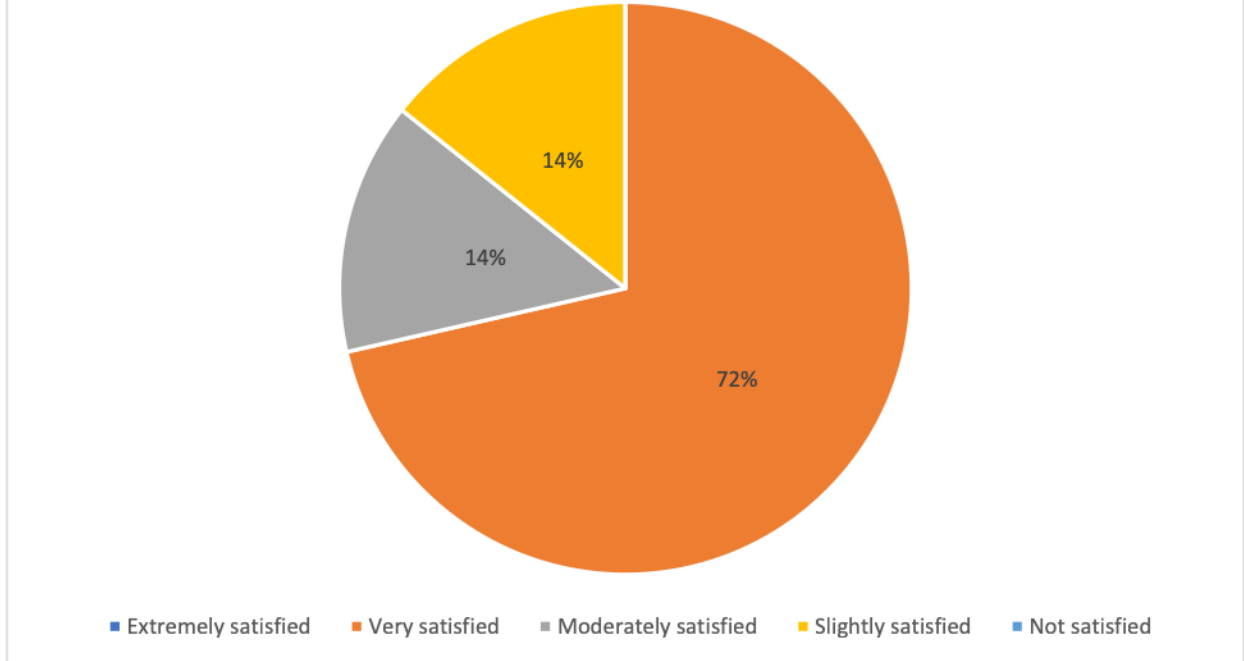


Figure 1. IRB approved case study from an interdisciplinary approach to determine undergraduate students' perspective about data analytics related concepts in engineering and aviation education using safety management systems and the overall implementation satisfaction.

## Undergraduate Learners at the University of Maryland Eastern Shore, Capstone Course: How effective is safety management systems to aviation safety when it comes to identifying hazards and its associated risks?

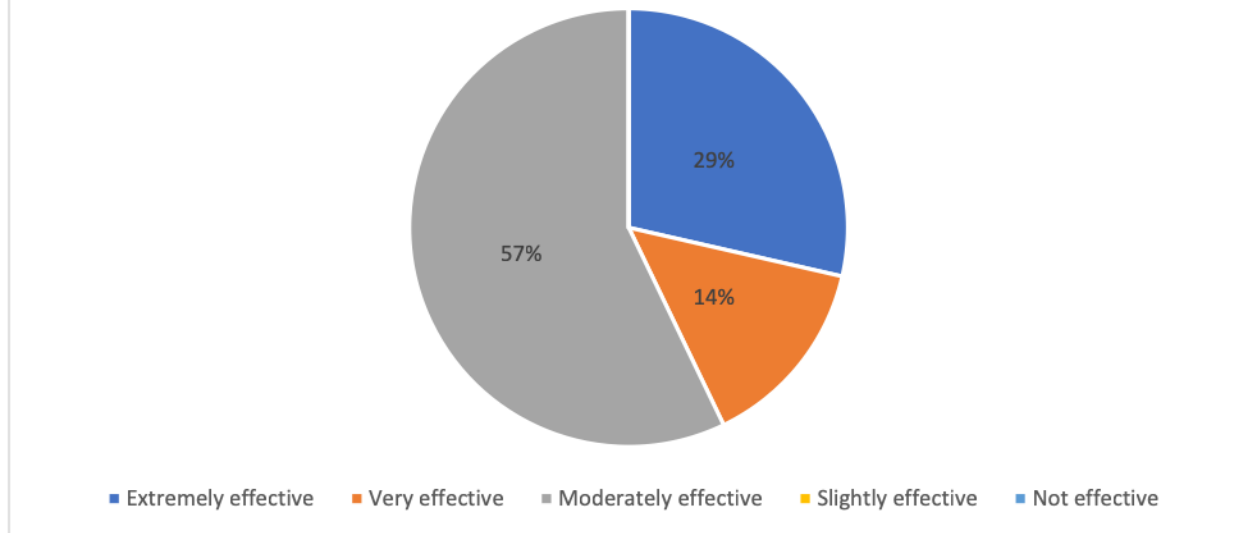


Figure 2. IRB approved case study from an interdisciplinary approach to determine undergraduate students' perspective about data analytics in engineering and aviation education using safety management systems and the overall effectiveness to learn and to identify key concepts in the field of practice.

This case study applies to undergraduate students as the findings mentioned the user experiences from an interdisciplinary perspective with the ability to promote data analytics according to industry practices, which positively had benefited learners in their fields. A majority of the learners believed that data analytics modeling such as safety management systems will be effective, and were overall satisfied with both the implementation of study and key techniques for advancement. Brown et al. (2018) explored the integration of data analytics with students and their ability to assess the potential research and practices in higher education. This engagement with the learners had explored the details of the market analysis proposed as a benefit to the industry, community impact, and higher education by adopting data analytics techniques (e.g., safety management systems) into an interdisciplinary approach (Brown et al., 2019).

### D. Reasonableness of Program Duplication

**1. Identify similar programs in the State and/or same geographical area. Discuss similarities and differences between the proposed program and others in the same degree to be awarded.**

From our research, we are aware of several universities in the State of Maryland that are currently offering and/or have proposed similar programs with data science, analytics, and engineering-focused. Hereby, the University of Maryland Eastern Shore’s offering of an interdisciplinary graduate program approach is proposed as a Master of Science in Data Science and Analytics Engineering. The differences between this proposed program and others is the degree to be awarded by the School of Business and Technology at the University of Maryland Eastern Shore will present interdisciplinary concept specific to its departmental and program offerings. The table below captures the current institutional name with program title, description, and geographical area as discussed in the requirements.

<b>Institution</b>	<b>Program Title</b>	<b>Description</b>	<b>Geographical Area (w/Delivery Method Assessment)</b>
University of Maryland Global Campus (UMGC)	Master of Science Data Analytics	The Master of Science in data analytics program at the University of Maryland Global Campus is designed to meet the rising need for highly skilled professionals who can transform the growing amount of institutional data into valuable assets.	The delivery method is online; however, the campus location is not in the same geographical area in reference to Largo, Maryland.
University of Maryland College Park	Master of Professional Studies in Data Science and Analytics	The MPS in Data Science and Analytics is a 30-credit graduate program designed for working professionals and can be completed in less than two years. Instruction is provided by UMD faculty and experts in the field.	The program campus location offering is at College Park, Maryland and according to the instructional delivery methods, the course instruction is face-to-face on the UMD College Park campus with at least one online course. From these findings: The campus location is not in the same geographical area.
Capitol Technology University	Technical Master of Business Administration in Business	The Technical Master of Business Administration in Business Analytics and Data Science allows students to integrate business and analytical	The program offers a 100% online option located in Laurel, Maryland. Hence, the program offering has an online component, the campus location is not in the same

	Analytics & Data Science	decision-making skills in a technologically complex business environment.	geographical area to service our community.
University of Maryland Baltimore County (UMBC)	Master of Professional Studies in Data Science	UMBC's Master of Professional Studies (MPS) in Data Science program prepares students from a wide range of disciplinary backgrounds for careers in data science.	The program offers a pathway in the delivery method at UMBC's main campus and Shady Grove campus location. The geographical area of the main campus is Baltimore, Maryland and the Shady Grove campus is Rockville, Maryland. Neither location is a part of the same geographical area as Princess Anne, Maryland. UMES has an off-site location at Shady Grove; hereby, the course offering plans to host the degree offerings at the Princess Anne campus location.
John Hopkins University	Master of Science in Data Analytics and Policy	This cutting-edge program empowers students to tackle meaningful policy challenges using analytics. Students graduate with the expertise to be data-driven decision makers and policy leaders in both the public and private sectors.	Both programs (MS in Data Analytics and Policy; and MS in Data Science) are either offered and listed as a delivery method of study with an online study or a hybrid study. From the previous findings with an online delivery method approach, the campus does not serve the same geographical area as UMES, as the institution's current campus location region is Baltimore, Maryland.
	Master of Science in Data Science	Enhance your career as a leader in a data-driven world and get a master's in data science online—no GRE required. Courses in Computer Science and Applied Mathematics provide a foundation for launching our masters in data science graduates into a variety of specialized careers, including data	



		pipeline and storage and statistical analysis.	
McDaniel College	Master of Science in Data Analytics	You'll notice right from the start that the Professional Masters in Data Analytics at McDaniel College is uniquely designed to prepare you for professional success. Every course in the curriculum integrates skills more typically found in arts and humanities courses that prepare the student to think more critically and through a more peripherally focused lens.	The delivery method with McDaniel College consists of a hybrid format with features on a full weekend per semester of an in-person class. This also includes an online experience with a hybrid format. With this approach, the demographic area that UMES services does not yield the flexibility to course interest in the Princess Anne location or the Eastern Shore community. McDaniel College's campus location is Westminster, Maryland.
Loyola University	Master of Data Science	Take your career to the next level with the online Master of Science in Data Science from Loyola University Maryland. This master's program provides the skills you need to become a data scientist. Students graduate ready for a career in the growing and in-demand field of data science.	The program offers an online delivery method option located in Baltimore, Maryland. As such, the Loyola University campus is not located in the same geographical area as the University of Maryland Eastern campus and service community.
Notre Dame University of Maryland	Master of Science in Analytics	The online Master of Science in Analytics prepares professionals to manage the architecture of knowledge from traditional- and online-based resources. The curriculum focuses on multidisciplinary competencies in knowledge management technologies, qualitative processes, and economic	The delivery method options include an online approach located in Baltimore, Maryland. As previously mentioned, our institutions with similar offerings of online in nearby regions do not service the location community here near the Eastern Shore region (e.g. Maryland, Virginia, and Delaware areas).

		principles of change risk management.	
Maryland Institute College of Art	Master of Professional Studies in Data Analytics and Visualization	Maryland Institute College of Art (MICA) developed the Master of Professional Studies (M.P.S.) in Data Analytics and Visualization program to teach professionals how to represent information and data in a visual and impactful way with the use of graphics, images, and dynamic interactive features. In this program, you will develop design expertise and analytical skills that are in increasing demand in our data-driven world.	The delivery method is mentioned according to the residency overview as a 3-day in-person residency as presented to experience the Maryland Institute College of Art campus. In addition, the class delivery discusses flexible and adaptive web-based tools, software, and resources to support the learning experience. The Maryland Institute College of Art campus is located in Baltimore, Maryland, and will not be in the same geographical area as the University of Maryland Eastern Shore.

**2. Provide justification for the proposed program.**

In the proposed program justification, out of the nine (9) institutions with 10 different program offerings in the State listed at a master’s level, there were no master’s degree programs offered in the same geographical area or with an engineering focus (i.e., data science and analytic engineering). Through the methods of experiential learning that have been emphasized, the graduate-level program at the University of Maryland Eastern Shore will be the campus’s first interdisciplinary graduate program in the School of Business and Technology. The offerings will serve the Eastern Shore community, the state, and the nation as the geographical area location welcomes the opportunity to promote interdisciplinary teachings, research, and service. Henceforth, as the only current classified R2: Doctoral Universities – high research activity, as of January 2022, in the Eastern Shore region of Maryland, this will support any emerging studies in the same geographical area for advancement through the graduate level offerings.

**E. Relevance to High-demand Programs at Historically Black Institutions (HBIs)**

**1. Discuss the program’s potential impact on the implementation or maintenance of high-demand programs at HBI’s.**

The uniqueness of the proposed high-demand program at the University of Maryland Eastern Shore is from the standpoint of the first academic program, within the School of Business and Technology, to have an interdisciplinary approach which directly impacts the effectiveness of academic program operational efficiency to advance innovation involving HBIs. Hereby, the interdisciplinary approach to implement and maintain current offerings reveals the need to explore

such efforts at underrepresented minority institutions. The program offerings of interdisciplinary efforts at HBIs are not usually considered in previous developments; hence, the challenge in STEM practices encourages learners to be diverse in education and research concept. According to the table above that identifies the reasonableness of program duplication with other HBCUs, our findings do not present a master level program with the offering of keywords titles within the State of Maryland. These keywords in the program title include data analytics, data visualization, data science, and data engineering. This is vital to the education trend in assessing and implementing maintenance of high-demand programs at HBIs.

## **F. Relevance to the Identity of Historically Black Institutions (HBIs)**

### ***1. Discuss the program's potential impact on the uniqueness and institutional identities and mission of HBIs.***

The relevance of the University of Maryland Eastern Shore as a Historically Black 1890 land-grant institution serves a distinctive identity for HBIs in the State of Maryland. As such, the University of Maryland Eastern Shore is the State of Maryland's only Historically 1890 Land-grant with programs unique to the State as a four-year serving institution. The University of Maryland Eastern Shore references the mission of a student-centered, doctoral research degree-granting university known for its nationally accredited undergraduate and graduate programs, applied research, and highly valued graduates. To prepare graduates to address challenges in a global knowledge-based economy, while maintaining its commitment to meeting the workforce and economic development needs of the Eastern Shore, the state, the nation, and the world. The proposed program is vital to the development of anticipated higher education demands that benefit the University of Maryland Eastern Shore through the promotion of research, teaching, and service.

## **G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes**

### ***1. Describe how the proposed program was established, and also describe the faculty who will oversee the program.***

#### **How Was the Proposed Program Established?**

The decision to develop an academic proposal for a graduate program in Data Science and Analytics Engineering was made possible by a \$100,000 cash donation from the Microsoft Corporation. Receiving the funding award from the Microsoft Corporation help accelerate UMES' ability to develop and implement a cutting edge interdisciplinary graduate degree in Data Science and Analytics Engineering which can draw students not only from the fields of Engineering and Computer Science but also from Accounting, Business Administration, Construction, Finance, Hospitality and Tourism, Management and Marketing, where data analytics is becoming a key aspect to the knowledge business students are expected to demonstrate in current and future corporate America.

#### **Describe the Faculty Who Will Oversee the Program**

The proposed program will be overseen and supported by full-time and part-time faculty from the Department of Engineering and Aviation Sciences, Department of Computer Science and Engineering Technology, Department of Hospitality and Tourism Management, Department of the Built Environment, and the Department of Business, Management, and Accounting. Details of the contributions of the School of Business and Technology faculty who can make such contributions to the program development and implementation are discussed in a later section of this document.

**2. Describe educational objectives and learning outcomes appropriate to the rigor, breadth, and (modality) of the program.**

In terms of educational objectives, it is the goal of the proposed program to:

1. Develop independent judgment and sound ethical values in expediting a project without jeopardizing its effectiveness, or cost;
2. Demonstrate effective communication of ideas utilizing spoken and written language;
3. Improve the professional technical practice of the Data Analytics field through continuing education and community service; and
4. Demonstrate humanistic values and responsibilities that promote active participation as productive citizens.

In terms of learning outcomes, the proposed program will build upon the Accreditation Board for Engineering and Technology, Inc. (ABET) 2022-2023 Criteria for Accrediting Computing programs. Graduates of the program will have the ability to:

1. Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions;
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline;
3. Communicate effectively in a variety of professional contexts;
4. Recognize professional responsibilities and make informed judgments in computing practice, based on legal and ethical principles;
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline; and
6. Apply theory, techniques, and tools throughout the data science lifecycle and employ the resulting knowledge to satisfy stakeholders' needs.

**3. Explain how the institution will:**

**a) provide for assessment of student achievement of learning outcomes in the program**

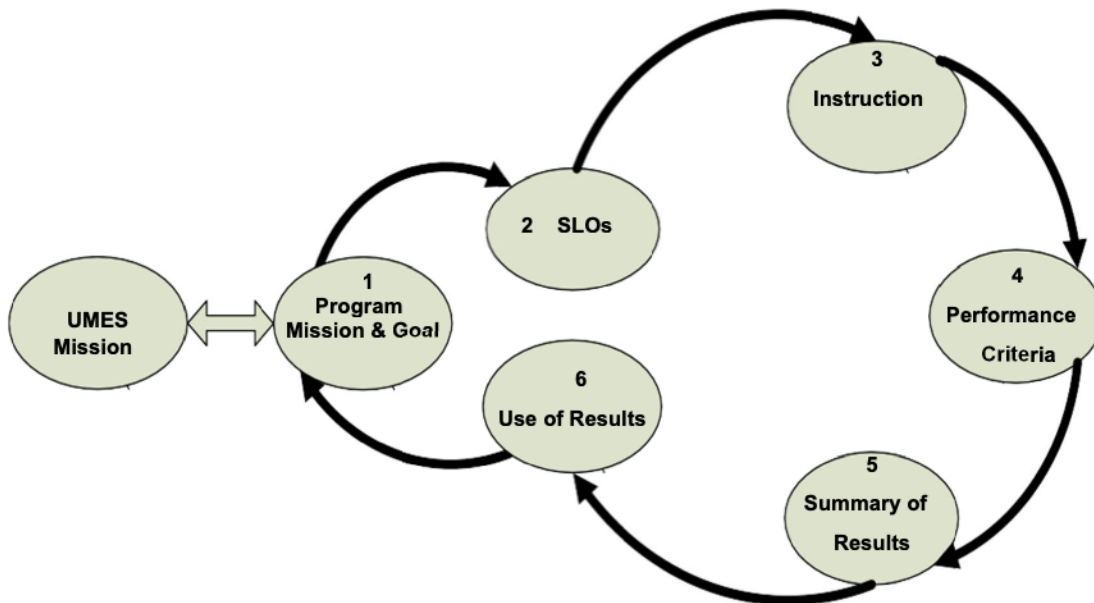
Periodic assessment of the impact of the proposed program will be monitored as part of the institutional assessment process, and include an evaluation program operation against budget and enrollment projects with primary benchmarks dictated by the parameters of the semester and academic year. Data on the program's operation (enrollment, student-credit-hour production, expenses, and revenue) includes an annual assessment report to be used to improve the quality and relevance of educational opportunities offered by the School of Business and Technology at UMES.

Assessment methods for student achievement of learning outcomes will be based on established school and departmental standards and will include the following:

1. Assess written and oral student presentations, written assignments, and research projects;
2. Evaluate student performance on exams, quizzes, and assignments in required major courses; and
3. Assess comprehensive theses or research project reports by presenting at regional and national conferences.

The Student Learning Outcomes Assessment Process (SLOAP) is the degree program's procedures to determine if the program's mission, objectives and learning outcomes are being met. It explains the required assessment data to be collected, the frequency and evaluation methods to be used to examine whether the performance criteria, which have been discussed previously and below, are being met.

### Student Learning Outcomes Assessment Process (SLOAP)



#### ***b) document student achievement of learning outcomes in the program***

The proposed program will document student achievement of the learning outcomes in the program in the same fashion as other currently accredited programs in the School of Business and Technology. Assessment Methods based on previously established educational objectives and learning outcomes for the proposed program would include the following:

1. assess written and oral student presentations, written assignments, and research projects;
2. evaluate student performance in exams, quizzes, and assignments in required courses of the program; and

3. Evaluate students through a comprehensive exam and course-based projects.

***4. Provide a list of courses with title, semester credit hours and course descriptions, along with a description of program requirements***

**Admission Criteria**

Students admitted into the proposed graduate program will be required to meet the following requirements for unconditional admission:

1. Applicants are required to have a four-year bachelor's degree from a regionally accredited institution in the United States or its equivalent from a foreign institution as determined by an evaluation service accepted by UMES. Students must have a strong background in business, computer science, engineering, mathematics, statistics, science, or technology.
2. A minimum undergraduate cumulative GPA of 3.0 on a 4.0 scale,
3. Two (2) semesters of Calculus,
4. One (1) semester of Linear Algebra,
5. One (1) semester of Statistics, and
6. Two (2) semesters of a programming/scripting language or demonstrated experience with software data analysis tools.

Note: a prospective student can be admitted into the proposed graduate program conditionally at the discretion of the proposed graduate program admission committee.

**Admission Application Packet Contents**

A complete admission dossier should include:

- A. A complete Graduate School Application;
- B. Application processing fee;
- C. A 500 to 750-word statement of purpose outlining the rationale for seeking admission in the program and personal and professional goals with a focus on obtaining a graduate degree in the data science field;
- D. Transcripts of all post-secondary academic work;
- E. Two letters of recommendation from individuals acquainted with the applicant's academic and/or professional experience and his/her potential to complete a graduate program;
- F. Proof of prerequisites;
- G. A one-page resume or vita; and
- H. International applicants, whose primary language is not English, must take the TOEFL exam and obtain a satisfactory score.

**Courses and General Requirements for Degree**

All students in the proposed Masters of Science in Data Science and Analytics Engineering program will take thirty (30) credit hours with the Thesis option, thirty-three (33) credit hours with the project option, or thirty-six (36) credit hours for the course-work only option of graduate-level courses to graduate from the program, not including any provisional admission course

requirements, over four semesters. Student must obtain a minimum grade of B for all courses counted towards graduation.

**Thesis option:** the student must take three core (9 credits), a minimum of five elective (15 credits) graduate-level courses, and six credits of thesis. The thesis must be supervised by a faculty member, as a thesis advisor. The initial thesis proposal must be defended with an oral presentation and approved by the student’s thesis committee (three members, including the advisor). The thesis must be submitted to the department in a bound form after the oral defense, which will occur after completing the thesis. A student is required to submit at least one conference paper from his/her thesis work before the defense.

**Non-thesis option:** the student must take three core (9 credits) and a minimum of seven engineering electives (21 credits) graduate-level courses and a 3-credit hour research project that must be approved by the project advisor. A copy of the resulting scholarly paper (if any) must be submitted to the department. A Student needs to perform a scholarly activity as part of his/her project work.

**Course-work only option:** the student will be required to take three core (9 credits) and a minimum of nine elective (27 credits) graduate-level courses.

**Suggested Program Structure**

	<b><u>Thesis Option</u></b>	<b><u>Project Option</u></b>	<b><u>Coursework Only Option</u></b>
<b>Core</b>	9	9	9
<b>Electives</b>	15	21	27
<b>Project</b>	N/A	3	N/A
<b>Thesis</b>	6	N/A	N/A
<b>Total</b>	<b>30</b>	<b>33</b>	<b>36</b>

**Proposed Course Assigned Program Structure**

**Core:**

- DSEN 600 Statistical inference with Business Applications 3 credits
- DSEN 610 Data Analysis 3 credits
- DSEN 615 Applied Statistics for Analytics 3 credits

**Electives:**

- DSEN 620 Cyber Analytics and Intelligence 3 credits
- DSEN 625 Spatial Technology and Data Analytics 3 credits
- DSEN 630 Financial Engineering, Management, and Modeling 3 credits
- DSEN 635 Analytical CRM (Customer Relationship Management) 3 credits

- DSEN 640 Accounting Analytics and Data Visualization 3 credits
- DSEN 645 Text Analysis for Business Application 3 credits
- DSEN 650 Machining Learning 3 credits
- DSEN 655 Predictive Analytics in Engineering and Aviation Systems 3 credits
- DSEN 668 Robotics. cross-listed with ENME/ENEE/ENCE 468 3 credits
- DSEN 665 AI and Big Data Analytics in Construction 3 credits
- DSEN 670 Data Analytics for Hospitality and Tourism Industry 3 credits

**Project Option:**

- DSEN 690 Data Analytics Master’s Project. 1-3 credits

**Thesis Option:**

- DSEN 695 Data Analytics Master’s Thesis. 1-6 credits

Proposal Course Rotation: Data Science In Data Science and Analytics Engineering									
	Fall 2023	Winter 2024	Spring 2024	Summer 2024	Fall 2024	Winter 2025	Spring 2025	Summer 2025	
DSEN 600	X								Core Courses
DSEN 610			X						Elective Courses
DSEN 615				✕					Project/Thesis Course
DSEN 620					X				
DSEN 625							X		
DSEN 630								✕	
DSEN 635	X								
DSEN 640			X						
DSEN 645				✕					
DSEN 650					X				
DSEN 655							X		
DSEN 668								✕	
DSEN 665	X								
DSEN 670			X						
DSEN 690	X	X	X	X	X	X	X	X	
DSEN 695	X	X	X	X	X	X	X	X	

**Proposed Course Descriptions**

**Course Master: Wei-Wei Zhu-Stone – Data Analytics**

**DSEN 610 Data Analysis**

**3 credits**

The course will cover the scientific decision-making process, understanding and visualizing data, and using predictive data analysis to study complex data sets. Graduate Standing and permission of the instructor. Instructional Delivery Method: On-line

**Course Master: Isaac Marcelin – Financial Analytics**

**DSEN 630 Financial Engineering, Management, and Modeling**

**3 credits**

Financial engineering, management, and modeling aim to provide engineers and data professionals the tools to create products using math and statistics to measure risk or invest money for a fund. It presents the essentials of financial modeling and shows how these can be solved numerically and simulated using computer-based software. First, it covers financial modeling fundamentals in corporate finance, financial statement simulation, portfolio problems, options, portfolio insurance, duration, and immunization. Second, it examines the issues and processes of short-term financing on industrial firms, financial analysis of cases, supplemented by readings to develop familiarity with sources and uses of working capital and the goals and problems involved in its management.



Third, it also covers the analysis necessary for such long-term financial decisions as issuance of stock or bonds, contracting leases or loans, and financing a new enterprise; mergers, capital budgeting, the cost of capital, and the valuation of a business. Fourth, it further examines financial statement ratio analysis and the use of the capital asset pricing model related to risks and returns. Fifth, it finally explores leverage and capital structure and international managerial finance to examine the overall financial policy decision-making process. Prerequisites: MATH 310, 319, 333 or 316, 410; or BUAD 253, 354; and FINA 340 or 440 or permission of the Instructor. Instructional Delivery Method: On-line

**DSEN 615 Applied Statistics for Analytics.**

**3 credits**

This course introduces multivariate regression and data modeling, emphasizing linear regression, analysis of variance (ANOVA) and hierarchical regressions, hazard regressions, including testing, estimation, diagnostics and plots, and their extension. It is a computer course that relies on STATA, R, and MATLAB to analyze data. Major highlights include data management, variable selection, inferences, and model diagnostics. It addresses more advanced methods such as scatterplot matrices enhanced by smoothed or density contours, and search tools for finding graphics with suggestive patterns. A final project will involve modeling and exploring an actual data set with practical implications. Prerequisites: MATH 310, 319, 333 or 316, 410; or BUAD 253, 354 or permission of the Instructor. Instructional Delivery Method: On-line

**Course Master: Dr. Rob Richerson - Marketing**

**DSEN 635 Analytical CRM (Customer Relationship Management).**

**3 credits**

Today, firms commonly use IT-managed operational CRM systems to facilitate the sales process, maintain prospective and current customer information, and document customer/firm interactions. However, data-driven firms go beyond just using CRM operationally and engage in Analytical CRM. Analytical CRM uses data science techniques to transform customer-related data into actionable insights for strategic or tactical purposes. This course will cover the data science concepts and analyses used in Analytical CRM. Topics will include customer lifetime value, customer equity, k-means clustering, hierarchical clustering, customer portfolio analysis, shopping basket analysis (affinity grouping), decision trees, predictive models for propensity to purchase and probability of churn, and RFM analysis. Additional topics may include sentiment analysis and multidimensional scaling for perceptual mapping. For each technique, students will learn the technique and run the analysis. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

**Course Master: Leslie West - Accounting**

**DSEN640 Accounting Analytics and Data Visualization.**

**3 credits**

This course will introduce analytical techniques for examining complex and large financial data sets. Students will obtain insights into analyzing financial information, assisting businesses with process improvement, enhancing operational efficiency, and developing risk assessments. Topics may include an overview of big data, problem assessment, financial statement analysis, data analysis and visualization, and managing risks for decision-making. The course will utilize MS Excel and Tableau. Prerequisite: Business Statistics. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

**Course Master: Fang “Grace” Yu - Business**

**DSEN 645 Text Analysis for Business Application.****3 credits**

This course is an introduction to analyzing text data with a focus on business applications, intuition, and how to use algorithms. Techniques covered include simple text matching, topic modeling, regex, tf-idf, word2vec, BERT, and more. Applications covered consist of content moderation for hate speech, analyzing customer feedback, optimizing naming and description strategies for discovery on search engines, creating recommendation systems for products, and more. The course requires an introductory course or more in linear algebra and Python programming. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

**DSEN 600 Statistical inference with Business Applications.****3 credits**

This course is an introduction to cross-sectional data analysis with a focus on business applications. The course will focus mainly on the intuitive understanding of the techniques used and how to use these techniques in SPSS (or R or Stata), with some linear algebra included. Topics covered include experiments, data cleaning, multiple linear regression, the Frisch-Waugh theorem, instrumental variables, regression discontinuities, and more. Applications covered include case studies of New Coke, the national debt, etc., and general problems, such as pricing strategy, demand projection, and customer retention. Students are required to have taken linear algebra and a probability course with calculus foundations. Students are encouraged to have some familiarity with SPSS, R, or Stata. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

**DSEN 650 Machining Learning.****3 credits**

This course introduces machine learning with a focus on business applications. This course will cover an intuitive understanding of the techniques used and how to use these techniques in Python, with some linear algebra included. Topics covered include sentiment analysis, word embedding, topic modeling, face detection, emotion detection, machine transcription, recommendation systems, and machine translation. These topics will be discussed regarding various algorithms and will cover related business fields for customer clustering, sales prediction, customer lifetime value, content creation, customer feedback analysis, and more. Students are required to have one course completed in linear algebra and one course in Python programming. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

**Course Master: Willie Brown/I.K. Dabipi - Aviation****DSEN 655 - Predictive Analytics in Engineering and Aviation Systems.****3****credits**

This course introduces design concepts, principles, and best practices in data science engineering that can be used to advance aviation systems and performances through predictive analytics techniques. The course covers the implementation of aviation performances and operational environments using data trends and application solutions with exploratory analysis and modeling. The learned topics to evaluate performance measures and methods include the use of data ingestion, processing, storage, and analytics. Learners are required to compare data models and system requirements by considering big data situations to evaluate predictive analytics techniques for modeling discovery in data science. Prerequisite: Graduate Standing. Instructional Delivery Method: Face-to-Face

**Course Master: Abhijit Nagchaudhuri - Robotics****DSEN 667 Robotics.****3 credits**

This course covers introduction to industrial manipulator systems; Kinematic and dynamic models of robotic arms; homogeneous transformations; forward and inverse kinematics; motion control through coordinate transformations; robotic vision and sensors. Cross-listed with ENME/ENEE/ENCE 468. Prerequisite: Graduate Standing. Instructional Delivery Method: Face-to-Face

**Course Master: Lufan Wang – Construction**

**DSEN 665 AI and Big Data Analytics in Construction.**

**3 credits**

In this course, students will learn about the latest AI technologies that are proactively used in today's practice, explore the fundamental of unresolved AI problems that are unsolved, and identify and address the perceptual gaps between what AI in AEC is doing, what it can do, and what it's advertised doing. Course assignments will include readings, lectures by AI and AEC experts, programming exercises, and hands-on course-long projects. The ultimate goal of the course is to help students build essential knowledge and AI skills towards driving innovation in their careers. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

**Course Master: Derrek Dunn – Cyber and Spatial**

**DSEN 620 Cyber Analytics and Intelligence.**

**3 credits**

This course covers the evaluations and applications of contemporary machine learning techniques in the cybersecurity field. Topics may include an overview of popular machine learning algorithms, application areas of machine learning in cybersecurity, vulnerability and risk assessment using machine learning techniques, and development of machine learning-based solutions to mitigate cyber threats and risks, and for informed decision making. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

**DSEN 625 Spatial Technology and Data Analytics.**

**3 credits**

This course covers rich geospatial data from government agencies, social media, and the semantic web. Students will be exposed to introductory methods in Spatial Data Analytics afforded by Global Positioning Systems (GPS), Remote Sensing (RS), Geographic Information Systems (GIS), Spatial Analysis, and Mapping technologies. The course is intended to develop students' abilities to apply spatial thinking and data analytics to problem-solving. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

**Course Master: Dr. Katherine A. Quinn – Hospitality and Tourism Management**

**DSEN 670 Data Analytics for Hospitality and Tourism Industry.**

**3 credit**

The course is designed to provide students with the fundamental concepts and practical applications of data analytics in the hospitality and tourism industry. Upon completion of the course, students will understand the decision-making process and will be able to develop strategies for managing revenue using real data, trend reports, and HOST and pipeline information provided by STR (Smith Travel Research), a hotel management analytics firm. Students will also earn the Certification in Hotel Industry Analytics (CHIA), with a passing exam grade of 70%. This globally-recognized professional credential validates an advanced knowledge in hotel industry analytics and is offered by the American Hotel & Lodging Educational Institute (AHLEI) in partnership with STR, the global source for benchmarking and forecasting data. Prerequisite: Graduate Standing. Instructional Delivery Method: On-line

### **Project Option**

#### **DSEN 690 Data Analytics Project.**

**1-3 credits**

This course consists of the developing and implementing individual research projects geared toward students' interests. Specific requirements related to each independent research study are approved on an individual basis. Course may be repeated. Instructional Delivery Method: On-line or Face-to-Face

### **Thesis Option**

#### **DSEN 695 Data Analytics Master's Thesis.**

**1-6 credits**

This course is required of all students involved in the preparation, data collection, and writing of the Master of Science (MS) thesis. Course may be repeated. Instructional Delivery Method: On-line or Face-to-Face

#### ***5. Discuss how general education requirements will be met, if applicable.***

The section is not applicable as the proposed program is at the graduate level and does not contain any general education requirements.

#### ***6. Identify any specialized accreditation or graduate certification requirements for this program and its students.***

The section is not applicable as the proposed program is at the graduate level and therefore is not required to meet any specialized accreditation or graduate certification requirements.

#### ***7. If contracting with another institution or non-collegiate organization, provide a copy of the written contract.***

The section is not applicable as the proposed program will not have a contract with another institution or non-collegiate organization.

#### ***8. Provide assurance and any appropriate evidence that the proposed program will provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.***

As with other academic programs offered by the University of Maryland Eastern Shore, the proposed program will provide students with clear, complete, and timely information on the curriculum, course and degree requirements, nature of faculty/student interaction, assumptions about technology competence and skills, technical equipment requirements, learning management system, availability of academic support services and financial aid resources, and costs and payment policies.

#### ***9. Provide assurance and any appropriate evidence that advertising, recruiting, and admissions materials will clearly and accurately represent the proposed program and the services available.***

As with other academic programs offered by the University of Maryland Eastern Shore, the proposed program will ensure that advertising, recruiting, and admissions materials will clearly

and accurately represent the proposed program and the services available. In addition, the program will be advertised alongside other academic graduate programs within the School of Business and Technology at UMES. Proper venues include Public Radio WESM 91.3, and social media such as UMES Facebook page, the University Key, as well as UMES alumni association, and other professional societies.

## **H. Adequacy of Articulation**

***1. If applicable, discuss how the program supports articulation with programs at partner institutions. Provide all relevant articulation agreements.***

The proposed program does not currently have articulation partners at the master's program level. However, the proposed program will support establishing an articulation with other system institutions at the bachelor's degree level, for example, a B.S./M.S. articulation between the B.S. in Data Science at Salisbury University and the proposed master's program at UMES. The goal of UMES is to work with partner institutions to provide a pathway for students interested in engineering or closely related field to obtain a M.S. in Data Science and Analytics Engineering degree.

## **I. Adequacy of Faculty Resources**

***1. Provide a brief narrative demonstrating the quality of program faculty. Include a summary list of faculty with appointment type, terminal degree title and field, academic title/rank, status (full-time, part-time, adjunct) and the course(s) each faculty member will teach in the proposed program.***

The following faculty are course masters and instructors to support the proposed program at its outset:

### **Full-Time Faculty**

**Dr. Willie Brown, Jr. is an Associate Professor in the Department of Engineering and Aviation Sciences.** Dr. Brown earned his Ph.D. Business Administration specializing in Homeland Security Leadership and Policy (Aviation Safety and Security) from Northcentral University through the Embry-Riddle Aeronautical University consortium agreement partnership for aeronautics-related disciplines. His master's degree is in Software Engineering (Aeronautics) from Embry-Riddle Aeronautical University. Dr. Brown also earned dual degrees from Elizabeth City State University, North Carolina, with a Bachelor of Science in Aviation Science, and a Bachelor of Science in Computer Science. In addition, Brown is a Federal Aviation Administration (FAA) licensed private pilot. His experiences include the North Carolina Department of Transportation, the Junior Research Faculty for the IEEE Conference on Communications and Network Security (CNS), and the Office of Naval Research/National Aeronautics and Space Administration. Dr. Brown is continuing his education, research, and teaching in data analytics with a focus on aviation safety and security, systems, and software development.

**Dr. Ibibia K. Dabipi is a Professor in Electrical Engineering.** He received his Ph.D. and M.S. in Electrical Engineering from Louisiana State University. His experiences include working at Bell

Communications Research and AT&T Bell Labs as a member of technical staff with a primary research focus in communications and networks.

**Dr. Derrek B. Dunn is a Professor in Computer Science and Engineering Technology.** He received his Ph.D. and M.S. in Electrical Engineering from Virginia Polytechnic Institute and State University (Virginia Tech). His experiences include working at Hewlett-Packard Laboratory and Oak Ridge National Laboratory as a summer faculty researcher with a primary research focus in communications and networks. Dr. Dunn teaches and conducts research in Cybersecurity, Global Positioning Systems, and Wireless Communication Systems.

**Dr. Isaac Marcelin is a tenured Associate Professor in the Department of Business, Management and Accounting.** He received his Ph.D. and MBA in Finance from Southern Illinois University Carbondale (SIUC). He served as an advisor in Finance to two Haitian Prime Ministers and provided consultancy to several global agencies, including USAID, UNESCO, Oxfam, etc. Dr. Marcelin teaches Financial Management, Derivatives, Money and Banking, International Finance with emphasis on Blockchain, Real Estate, etc. His research emphasizes political institutions and banking.

**Dr. Abhijit Nagchaudhuri is a Professor in Mechanical Engineering.** He received a Ph.D. degree in Mechanical Engineering from Duke University. His teaching and research areas are in the fields of robotics and mechatronics, remote sensing and precision agriculture, and biofuels and renewable energy.

**Dr. Katherine A. Quinn is an Assistant Professor of Finance and Technology in the Department of Hospitality & Tourism Management.** Dr. Quinn is a Certified Hospitality Educator (CHE) and holds certification from the AHLEI in Hotel Industry Analytics (CHIA). She received her doctorate in Organizational Leadership from the University of Maryland, Eastern Shore, and her Master of Business Administration degree in Finance from the University of Maryland, Smith School of Business. She graduated cum laude from the University of Maryland, where she earned a Bachelor of Science degree in Marketing. She is an active member of the International Council on Hotel, Restaurant, & Institutional Education (CHRIE) and is a Life Member and Chapter Officer for the Honor Society of Phi Kappa Phi (PKP). Her research interests include the role of grit and self-discipline in student success, the adoption of e-learning resources to enhance student achievement, and the skills and competencies necessary for successful careers in the hospitality industry.

**Dr. Rob Richerson is an Assistant Professor of Marketing in the Department of Business, Management and Accounting.** He received his Ph.D. in Marketing from the University of Kentucky, and his MBA from the University of Southern Mississippi. Dr. Richerson conducts research in Consumer Behavior and Marketing. Dr. Richerson teaches Content Marketing, Marketing Research, Sales Management, Marketing Principles, and Marketing Fundamentals for Small Businesses/Entrepreneurs.

**Dr. WeiWei Zhu-Stone is an Associate Professor in Computer Science and Engineering Technology.** She received a Ph.D. degree in Applied Mathematics and a Master of Science in Computer Science from the University of Missouri-St. Louis. Her industrial experience includes

working at Panda Electronics Group Co., Ltd., in Nanjing, China. She has taught over 20 courses in multi-disciplines, and advised students' research and graduate projects at both the undergraduate and graduate levels. Her research interests include Blockchain, big data analysis, game-based learning, tsunami prediction, wavelet analysis, and non-uniform B-spline analysis. Dr. Stone has been active in serving the professional areas as well as the local community. She also directs the graduate program of the department.

**Dr. Leslie L. West is an Assistant Professor in the Department of Business, Management and Accounting.** She received her Ph.D. from Hampton University and M.S. from Old Dominion University. She has obtained diverse experiences as an auditor and analyst from federal and state government, manufacturing, financial, and healthcare industries. She has worked with the U.S. Government Accountability Office, Pepsi Bottling Ventures, LLC, and the North Carolina Department of State Treasurer. Dr. West teaches and conducts research in Auditing, Financial Accounting, and Business Communication.

**Dr. Grace F. Yu-Buck is an Assistant Professor in Marketing in the Department of Business, Management and Accounting.** She received her Ph.D. in Marketing from the University of Utah. Dr. Yu-Buck teaches Principles of Marketing, Retail Management, and Marketing Software Applications. Her research currently focuses on consumer behavior and she explores the topic of consumer behavior with methods ranging from experiments to machine learning.

### **Part-Time (Adjunct) Faculty**

**Dr. Celeste Chamberlain, CISSP, is a part-time faculty member in the Department of Computer Science and Engineering Technology.** She received her D.Sc. in Emergency Management from Jacksonville State University, M.S. in Informatics from Northeastern University, and B.Sc in Computer Science from Hampton University. Her experiences include working with the U.S. Senate Homeland Security and Governance Affairs Committee as a cybersecurity legislative advisor, and 20 years creating cybersecurity governance under the Department of Homeland Security.

**Dr. Lufan Wang is a part-time faculty member in the School of Business and Technology.** She received her Ph.D. and M.S. in Civil Engineering with a concentration in computational science and engineering from the University of Illinois at Urbana-Champaign (UIUC). Her research interests lie in data analytics to better understand and model the behavior and interactions between the urban and human systems for the development and operation of smart, sustainable, and resilient buildings, infrastructure systems, communities, and cities.

***2. Demonstrate how the institution will provide ongoing pedagogy training for faculty in evidenced-based best practices, including training in:***

***a) Pedagogy that meets the needs of the students***

The Center for Teaching Excellence (CTE) provides ongoing pedagogy training for faculty in evidence-based best practices to support high-impact practices pedagogy to meet the needs of UMES students. To accomplish its mission of ensuring expanding and enhancing faculty pedagogy

training, CTE has developed three broad program areas to support faculty teaching success which includes evaluation of teaching techniques, professional development of faculty as it relates to pedagogy, and recognition of faculty who have demonstrated outstanding pedagogy methodology.

The evaluation of teaching techniques program includes the use of student experience of learning surveys, peer observation of teaching and open classroom week. The professional development of faculty program includes funding to attend pedagogy conferences, faculty workshops, FACTE working group, seminar series for new faculty, and an innovation in teaching & learning conference. Lastly, CTE's faculty recognition program includes student choice for teaching excellence e-badge, CTE website – faculty spotlights, and SOTL publication opportunities.

***b) The learning management system***

The Center for Instructional Technology and Online Learning (CITOL) at UMES supports the development, design, and delivery of online and hybrid programs, classes, and workshops with a focus on flexibility, resiliency, equity, accessibility, privacy, and safety (FREAPS). CITOL assists faculty, staff, and students in all aspects of digital teaching and learning concerning pedagogy and technology. This includes the use of the Canvas Learning Management System, Echo360, Google Workspace, Respondus 4.0, and Respondus LockDown Browser.

***c) Evidence-based best practices for distance education, if distance education is offered.***

The Center for Instructional Technology and Online Learning (CITOL) at UMES supports the development, design, and delivery of online and hybrid programs, classes, and workshops with a focus on flexibility, resiliency, equity, accessibility, privacy, and safety (FREAPS). CITOL assists faculty, staff, and students in all aspects of digital teaching and learning concerning pedagogy and technology. This includes the use of the Canvas Learning Management System, Echo360, Google Workspace, Respondus 4.0, and Respondus LockDown Browser. Other services offered by the Center for Instructional Technology and Online Learning include: supporting Canvas Learning Management System (LMS) and other instructional software which can be found on the CITOL website: new resources; providing ongoing professional development through virtual workshops; conducting UMES Online Teaching Certification & Course Quality Review; developing interactive and assessment materials for classes; and helping troubleshoot student problems on LMS.

**J. Adequacy of Library Resources (as outlined in COMAR 13B.02.03.12).**

***1. Describe the library resources available and/or the measures to be taken to ensure resources are adequate to support the proposed program.***

The Frederick Douglass Library is the only library on the University of Maryland Eastern Shore (UMES) campus. As a member of the University of System of Maryland and Affiliated Institutions (USMAI) consortium, the Frederick Douglass Library is affiliated with 17 public universities and colleges in the state of Maryland. The integrated library system ALEPH makes it possible for patrons to have 24/7 access to USMAI library collections and electronic resources. In-person visits to the library are available 91.5 hours per week including weekends.



The Frederick Douglass Library has the following resources available and/or the measures to be taken to ensure resources are adequate to support the proposed programs:

Books, periodicals, and other reference materials may be located and obtained for patron usage at any time online via the library catalog, online databases, interlibrary loan, inter-campus loan, or by visiting the library.

ILLIAD (Interlibrary Loan) service allows students, faculty, and staff to take advantage of the millions of items from other universities that are not available at the Frederick Douglass Library.

Interlibrary Loan allows the borrower to request items (books, and articles from non-university of Maryland System libraries. The average time to receive an article is 2 weeks. The average time to receive a book is 3 weeks. There is also Rapid Interlibrary Loan (Rapid ILL) where most articles may be received within 24 hours.

Borrowers are notified by email from the FDL staff to pick up items from the Interlibrary Loan service desk. Many articles requested will be received electronically and available to be accessed within ILLIAD.

Inter-campus loans may be requested from another University of Maryland System Library and delivered to the FDL for patron pick-up. The average time to receive a book is 3-5 days.

Resources that are available electronically via the Frederick Douglass webpage are databases, e-books and e-journals. Open Education Resource Textbooks is a search interface that allows faculty to retrieve OER resources to be used as course materials at no cost to students.

There are over 140 databases pertaining to research in 17 subject areas.

**Databases By Subject**

Agriculture	Health & Medicine
Business Management & Accounting	History
Computer Science & Engineering Technology	Hospitality & Tourism Management
Criminal Justice & Government	Human Ecology
Education	Life Sciences
Engineering & Aviation Science & Built Environment	Pharmacy
English & Modern Languages	Physical Sciences
Fine Arts	Physician Assistant
	Social Sciences

**Library Holdings as of 2022 for Proposed Degree Programs**

<b>New Program(s)</b>	<b>eJournal Titles</b>	<b>eBooks</b>
Applied Computing and Engineering	125	500
Construction Engineering Program	150	750
Biomedical & Bioengineering Program	20	400
Simulation & Game Development Program	40	150
Aviation Science	25	100

Print books and periodicals are located on the three floors of the Frederick Douglass Library. Periodicals are housed on the Lower Level. Reference books are on the first floor. Circulating and Special Collections books are located on the second floor of the library.

To ensure that resources are adequate to support the proposed programs, the library director and library liaisons will network and collaborate with program faculty with the selection of resources to be housed in the library. There is a one-credit Library Information Literacy class that is taught each semester, winter and summer sessions. Individual classroom library sessions are also taught upon request by the instructor. This instruction can range from basic research and knowledge of the library to the highest level of research for those seeking graduate degrees.

The University assures that institutional library resources meet the new program needs. For the proposed degree program, typically library resources include textbooks, reference books, and technical papers. Although UMES does not have the IEEE Digital Library, IEEE Xplore, the technical papers could be accessed through the Interlibrary Loan (ILL) services.

**K. Adequacy of Physical Facilities, Infrastructure and Instructional Equipment (as outlined in COMAR 13B.02.03.13)**

- 1. Provide an assurance that physical facilities, infrastructure and instruction equipment are adequate to initiate the program, particularly as related to spaces for classrooms, staff and faculty offices, and laboratories for studies in the technologies and sciences.***

*Physical Facilities: No additional facilities are required.*

The University of Maryland Eastern Shore, School of Business and Technology, Department of Computer Science and Engineering Technology is housed in the Engineering and Aviation Science Complex within a 166,000 square feet facility which was completed in 2015/2016.

The Department of Computer Science and Engineering Technology has six dedicated computer laboratories (where students learn programming and coding using C++, COBOL, Assembly, Java, Python, Networking, SAS, etc.) at their disposal, including:

- EASC 2112 - Supercomputer Lab (contains the mainframe)

- EASC 2108 - Graduate Lab (22 computer stations with private desks and overhead storage that graduate students may use for conducting research and completing projects)
- EASC 2122 - CS Computer Lab Computer Programming (classroom/lab with 31 computer stations loaded with software, applications, and programs)
- EASC 2121 - CS Computer Lab Computer Programming (classroom/lab with 35 computer stations loaded with software, applications, and programs)
- EASC 2090 - Software Engineering Lab (classroom/lab with 28 computer stations loaded with a variety of software, applications, and programs)
- EASC 2091 - Database Lab (classroom/lab with 35 computer stations loaded with software, applications, and programs)
- The Department has five dedicated laboratories for engineering technology:
- ATC 1046 – Electronics Lab: The Electronics Lab contains circuit analysis and test equipment utilized by the Electrical/Electronic Engineering Technology program. The equipment includes function generators, oscilloscopes, digital multimeters, a PCB milling machine, high power generation, and transmission trainer, soldering equipment, and other various test equipment. The lab is fitted with 14 computers with double screen monitors that host several types of software related to electronics.
- ATC 1050 – Communications Lab: The Communications Lab contains specialized equipment for analyzing and testing Radio Frequency (RF) and Microwave communication signals and systems. The equipment includes two network analyzers, two spectrum analyzers, two Lab-Volt analog communications, trainers, two Lab-Volt digital communication trainers, LCR meters, frequency counters, oscilloscopes, and an antenna design and testing trainer.
- ATC 1045 – Global Positioning Systems (GPS) Laboratory: The GPS Lab is a dedicated lab space for developing and testing communication systems related to GPS. This lab includes a grant funded \$250,000 CAST Navigation system for simulating and modeling advanced navigation technology related to military, federal, and commercial sectors of industry.
- EASC 1028 – Communications Laboratory: The Communications Laboratory is a shared laboratory space with the Department of Engineering. This Lab includes 32 computers with various engineering, programming, and simulation software. This computer lab is fitted with five wall-mounted LCD screens for multiple viewing angles and small work groups.
- EASC 1028 – Embedded Systems Laboratory: The Embedded Systems Laboratory is a shared laboratory with the Department of Engineering. This laboratory contains equipment for designing, testing, and simulating embedded devices and systems. The equipment in this lab includes benchtop multimeters, oscilloscopes, function generators, 3D printers, Bolt Sphero robots, digital logic analyzers, digital electronics trainers, soldering stations, and 10 computers.

These labs can support the instruction in the new courses and research activities as part of the proposed degree program. A complete list of computer science and engineering

technology labs with brief descriptions can be found using the link:  
<https://wwwcp.umes.edu/cset/cset-laboratories/>

All engineering faculty and staff have individual offices that will facilitate student advising, office hours, etc. Sufficient classrooms are available also in the same building, which makes it very convenient for students to take classes and conduct laboratory experiments.

*Infrastructure Equipment: The program does not need any additional infrastructure equipment.*

All faculty and staff in the School of Business and Technology have individual offices that will facilitate student advising, office hours, etc. Sufficient classrooms are available also in the same building, which makes it very convenient for students to take classes and conduct laboratory experiments.

**2. Provide assurance and any appropriate evidence that the institution will ensure students enrolled in and faculty teaching in distance education will have adequate access to:**

**a) An institutional electronic mailing system, and**

All students who are admitted and enrolled at UMES are assigned a Google Gmail email system and have access to the Google Meets video conferencing systems.

**b) A learning management system that provides the necessary technological support for distance education**

Faculty support for development and instructions is provided by the Information Technology Department, Center for Instructional Technology and Online Learning (CITOL), and Academic Computing Unit professionals. The learning management system (LMS) is available for instructional design, software development, educational research, Canvas Learning Management System (LSM), etc. These technologies and opportunities ensure students enrolled in courses and faculty development for teaching includes adequate access to the learning resources.

In addition, the Center for Instructional Technology and Online Learning (CITOL) at UMES assists faculty and students in all aspects of e-learning including hosting, training, development, and support of the Canvas Learning Management System, Google Education Plus, Echo360, and Respondus. UMES' web portal is a single sign-on allowing students, faculty, and staff access to:

- HawkWeb - a system where student enrollments and registrations, class rosters, and administrative functions related to academics are located.
- Canvas - the learning management system where course content can be published as well as where the entire online course experience for students is managed.
- Web Help Desk - the Information Technology Help Desk system where you can create a ticket to request assistance for your computer, networking, and telephone needs.

The UMES campus has wireless networking access points to allow network access from a wireless-enabled device like a laptop, smartphone, or tablet.

**L. Adequacy of Financial Resources with Documentation**

**1. Complete Table 1: Resources and Narrative Rationale. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each resource category. If resources have been or will be reallocated to support the proposed program, briefly discuss the sources of those funds.**

TABLE 1: RESOURCES					
Resources Categories	(Year 1)	(Year 2)	(Year 3)	(Year 4)	(Year 5)
1. Reallocated Funds <sup>1</sup>	\$95,900	\$95,900	\$95,900	\$95,900	\$95,900
2. Tuition/Fee Revenue <sup>2</sup> (c+g below)	\$95,208	\$135,056	\$236,812	\$281,025	\$326,912
a. # FT Students	5	10	15	20	25
b. # Annual Tuition/Fee Rate	\$9,300	\$9,486	\$9,676	\$9,869	\$10,067
c. Annual / Full Time Revenue (a x b)	\$46,500	\$94,860	\$145,140	\$197,380	\$251,675
d. # PT Students	5	5	5	5	5
e. Credit Hour Rate	\$413	\$422	\$430	\$439	\$447
f. Annual Credit Hours	12	12	12	12	12
g. Total Part Time Revenue (d x e x f)	\$24,780	\$25,320	\$25,800	\$26,340	\$26,820
3. Grants, Contracts & Other External Sources <sup>3</sup>	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000

4. Other Sources	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
TOTAL (Add 1 - 4)	\$211,108	\$250,956	\$352,712	\$396,925	\$442,812

**Narrative Rationale for Resources**

1. Reallocated Funds

One FTE faculty position will be reallocated from existing programs.

2. Tuition and Fee Revenue

We assumed that tuition and fees will increase for the next five years (\$9,300, \$9,486, \$9,676, \$9,869, and \$10,067). The in-state part-time tuition rate per credit hour is currently \$413 per credit. This value was used in calculating the revenue assuming 9 credits per semester for full-time students and 12 credits per academic year for part-time students.

3. Grants and Contracts

The Microsoft Corporation has provided a \$100,000 cash gift to assist UMES with the development and implementation of the proposed program. The funds are allocated for use over the first five years of the program's operation.

4. Other Sources

No additional sources of funding are expected at this time.

Total Year: 5-year estimate is provided.

**2. Complete Table 2: Program Expenditures and Narrative Rationale. Provide finance data for the first five years of program implementation. Enter figures into each cell and provide a total for each year. Also provide a narrative rationale for each expenditure category.**

TABLE 2: EXPENDITURES					
Expenditure Categories	(Year 1)	(Year 2)	(Year 3)	(Year 4)	(Year 5)
1. Total Faculty Expenses (b + c below)	\$139,740	\$139,740	\$139,740	\$139,740	\$139,740
a. # FTE	1.67	1.67	1.67	1.67	1.67
b. Total Salary	\$102,000	\$102,000	\$102,000	\$102,000	\$102,000

c. Total Benefits (37%)	\$37,740	\$37,740	\$37,740	\$37,740	\$37,740
2. Total Administrative Staff Expenses (b + c) below	0	0	0	0	0
a. # FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c. Total Benefits	0	0	0	0	0
3. Total Support Staff Expenses (b + c below)	0	0	0	0	0
a. # FTE	0	0	0	0	0
b. Total Salary	0	0	0	0	0
c. Total Benefits	0	0	0	0	0
4. Equipment	\$0	\$0	\$0	\$0	\$0
5. Library	0	0	0	0	0
6. New or Renovated Space	0	0	0	0	0
7. Other Expenses	\$0	\$0	\$0	\$0	\$0
TOTAL (Add 1 - 7)	\$139,740	\$139,740	\$139,740	\$139,740	\$139,740

**Narrative Rationale for Expenditure**

1. Faculty (# FTE, Salary and Benefits)  
Each year over the next five years, the proposed program will employ 1.67 FTE faculty per hired (with backgrounds in the proposed program course) to operate the program.  
There will be no need for additional administrative staff. The existing departments' and school administrative staff will be sufficient to run the program.
2. Support Staff (# FTE, Salary and Benefits)  
None
3. Equipment  
None.
4. Library

None.

5. New and/or Renovated Space  
Not needed

6. Other Expenses  
None.

**M. Adequacy of Provisions for Evaluation of Program (as outlined in COMAR 13B.02.03.15).**

***1. Discuss procedures for evaluating courses, faculty and student learning outcomes.***

**Course Evaluation**

The University of Maryland Eastern Shore has a comprehensive course and program evaluation process. Each course syllabus has a set of written student learning outcomes. The course learning outcomes are assessed through embedded questions on tests, assignments, and portfolios that address specific course outcomes. Data is collected to analyze results and used to improve course curriculum and pedagogy.

Once the program is launched, the courses will enter the course evaluation system. Teaching evaluation asks students to reflect on the course structure, the course content, and the instructor's performance. Summary data will be reviewed by faculty members, the program chair, and the school administration to determine whether revision or improvement actions are necessary.

Achievement of the program outcomes will be assessed using direct and indirect methods as described in the proposed Assessment Plan developed by the School of Business and Technology faculty at UMES for the proposed Data Science and Analytics Engineering. The assessment procedure is currently being developed to evaluate the proposed program's courses will be designed to be in line with the continuous program improvement as required by other accreditation bodies that review other degree programs in the School of Business and Technology at UMES including the American Council for Construction Education (ACCE), National Council for Accreditation of Teacher Education (NCATE), now called Council for the Accreditation of Educator Preparation (CAEP), Association to Advance Collegiate Schools of Business (AACSB), Accreditation Commission for Programs in Hospitality Administration (ACPHA), Professional Golfers' Association of America (PGA), and Accreditation Board for Engineering and Technology (ABET).

**Faculty Evaluations**

Faculty evaluations are conducted with an initial meeting at the start of each academic year, a mid-year meeting typically in January of each academic year, and a final evaluation meeting in April of each academic year. The faculty evaluation process at UMES is as follows:

At the beginning of the academic year, the faculty is required to meet with the department chair to discuss goals and objectives for the academic year. The individual faculty objectives must reflect:



- Departmental, school, and university goals;
- Faculty assignment (defined as % time allocated for each category based on appointment and release time awarded for that year);
  - Note: Faculty who are on 100% teaching lines with no approved release time are expected to have the following % breakdown: 50%, teaching 35 % scholarship, 15% service; and
- Faculty member's professional development.

During the academic year, the department chair would be informed of any major changes made to the objectives. If necessary, the department chair will share information with the faculty member regarding the areas of concern.

In January, the faculty will meet with the chair to review progress towards the objectives.

In April, each faculty member will submit the faculty evaluation document to the department chair. The Department Chair will review the information and discuss his/her evaluation with the faculty member. Students' evaluations of instruction will be utilized in this discussion between the Chair and faculty members. Copies of the summary evaluations should be attached, as they become available. Note: Peer review of teaching will be included if done.

### **Student Learning Outcome Evaluation**

Based on established school standards, we will establish an ongoing program evaluation where we,

- Assess samples of student performance on computer-based problems and projects.
- Assess samples of the use of technology in student presentations.
- Assess samples of the group and individual case studies.
- Assess written and oral student presentations, written assignments, and research projects.
- Track analytical performance in courses.
- Evaluate student performance in exams, quizzes, and assignments in elective courses.
- Assess comprehensive final exams in core courses.

Assessment instruments include graded student work, and the evaluation of written project papers, and presentations. The achievement levels are determined using the rubrics developed separately for each outcome.

***2. Explain how the institution will evaluate the proposed program's educational effectiveness, including assessments of student learning outcomes, student retention, student and faculty satisfaction, and cost-effectiveness.***

In addition, every faculty is evaluated each year. The evaluation process includes an assessment of faculty teaching, faculty research record and productivity, school-wide and department service. To receive a high evaluation, a faculty member must demonstrate effective teaching, active scholarly activities, publication, etc. There is also a provision for the administration to set out an

improvement plan for faculty members who have not done well in the area of teaching. Tenured faculty will undergo a five-year post-tenure review.

Program assessment takes place in a six-year cycle. Data regarding program enrollment, retention, and graduation rates are collected by the Office of Decision Sciences and Visualization in conjunction with the program coordinator. The data are analyzed against program outcomes and results are used to improve the program.

#### **N. Consistency with the State's Minority Student Achievement**

##### ***1. Discuss how the proposed program addresses minority student access & success, and the institution's cultural diversity goals and initiatives.***

The University of Maryland Eastern Shore mission is compatible with the State of Maryland's minority achievement goals. The University of Maryland Eastern Shore is an 1890 land grant HBCU. Our programs attract a diverse set of students with the majority of the student population being African-American those who are multiethnic, and multicultural. The University actively recruits a minority population for all undergraduate and graduate-level degrees. Special attention is also provided to recruit diverse groups into the STEM and multidisciplinary programs at all degree levels including undergraduate, master's, and doctoral. The same attention will be given to the M.S. in Data Science and Analytics Engineering program.

As part of UMES Strategic Plan Subgoal 4.1: Improve structure for attracting, developing, and retaining high quality and diverse students; UMES takes pride in the diversity of its faculty, staff, and students with representation from 37 states and 47 countries. UMES values people of different ethnicities, orientations, cultures, and perspectives. The University of Maryland Eastern Shore has one of the most racially and ethnically diverse student populations in the University System of Maryland. Based on fall 2017 data, UMES faculty were 56% African American, 27% White, 5% Asian, 1% American Indian, and 5% international. Student race and ethnicity statistics from fall 2017 reflect a student population that was 69.7% African American, 12.3% White, 8.8% two or more races, 3.6% Hispanic, 1.2% Asian, and 3.8% international.

UMES offers the most competitive tuition rates in the state of Maryland compared to other institutions in Maryland. This improves minority student access. Our program appeals to minority students, as evidenced by the high proportion of minority student enrollment in UMES degree programs. We support educationally disadvantaged minority students by offering remediation and mentoring relationships. We also have a policy that allows us to offer provisional admission to students with a GPA less than 2.75 and who possess qualities or life experiences that suggest they are well suited for the data science profession.

#### **O. Relationship to Low Productivity Programs Identified by the Commission:**

##### ***1. If the proposed program is directly related to an identified low productivity program, discuss how the fiscal resources (including faculty, administration, library resources and general operating expenses) may be redistributed to this program.***

The proposed Master of Science in Data Science and Analytics Engineering program is not directly related to an identified low productivity program at UMES.

## **P. Adequacy of Distance Education Programs**

### ***1. Provide affirmation and any appropriate evidence that the institution is eligible to provide Distance Education.***

At UMES, we are committed to continually improving our online courses and our distance education program. UMES participates in *The State Authorization Reciprocity Agreement*. Some of the benefits for students of our institutional participation in SARA include greater access to online programs, improved the quality of distance education, and reduced institutional costs (which keeps everyone's costs lower). Currently, 47 states and the District of Columbia participate in SARA. "*The State Authorization Reciprocity Agreement* is a voluntary agreement among its member states and U.S. territories that establishes comparable national standards for interstate offering of postsecondary distance-education courses and programs. It is intended to make it easier for students to take online courses offered by postsecondary institutions based in another state" (NC-SARA.org).

The University of Maryland Eastern Shore (UMES) is submitting a proposal for a Master of Science in Data Science and Analytics Engineering. The proposed program will be offered both online and in a traditional face-to-face format. The current faculty in the Department of Business, Management and Accounting, Department of Computer Science and Engineering Technology, Department of Engineering and Aviation Sciences, and Department of the Built Environment will serve as the majority of the instructors in the new program. Any new instructors recruited to teach online would be required to meet the same qualifications as the current faculty. All faculty teaching in the online version of the program will be required to complete UMES Online Learning Training and the School of Business and Technology recommends Quality Matters training, Online Learning Consortium, or other comparable training for its instructors.

### ***2. Provide assurance and any appropriate evidence that the institution complies with the C-RAC guidelines, particularly as it relates to the proposed program.***

UMES' commitment to online teaching is demonstrated by the resources of its Center for Instructional Technology and Online Learning (CITOL) founded in 2006, which provides a faculty computer lab, course development, instructional, and technical support to new and current faculty. The Center for Instructional Technology and Online Learning (CITOL) at UMES supports the development, design, and delivery of online and hybrid programs, classes, and workshops with a focus on flexibility, resiliency, equity, accessibility, privacy, and safety (FREAPS). CITOL assists faculty, staff, and students in all aspects of digital teaching and learning concerning pedagogy and technology. This includes the use of the Canvas Learning Management System, Echo360, Google Workspace, Respondus 4.0, and Respondus LockDown Browser. As C-RAC 2021 requires programs to provide details about practices to engage and assist distance education students; CITOL facilitates student-centered training and workshops, provides students mentoring and help desk support, and hosts a repository of student-centered LMS and online learning resources. The School of Business and Technology in addition to the Center for Instructional Technology and

Online Learning will assure the degree program adheres to C-RAC Guidelines for the Evaluation of Distance Education.

### References:

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Columbus, L. (2017). IBM predicts demand for data scientists will soar 28% by 2020. <https://www.forbes.com>

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Woodie, A.(2020). Why data science is still a top job. <https://www.datanami.com/>

## Appendix A: Funding Letter from Microsoft Corporation

Microsoft Corporation  
One Microsoft Way  
Redmond, WA 98052-6399

Tel: 425 882 8080  
Fax: 425 706 7329  
www.microsoft.com



April 2, 2021

University of Maryland Eastern Shore  
Attn: Dr. Derrek Dunn  
Comptroller's Office  
SDC Building, Suite 1160  
Princess Anne, MD 21853-1299

Dear Dr. Dunn:

Microsoft is pleased to provide University of Maryland Eastern Shore with a \$100,000 unrestricted gift to support funding requested from our recent round of Invitation for Proposals called Impact 2020. We would like to support your efforts to fund faculty to develop 10 interdisciplinary graduate Data Science Engineering courses (\$40,000) and provide the start-up funds to offer the interdisciplinary graduate program in Data Science Engineering (\$60,000).

Microsoft is committed to compliance with any and all applicable laws, regulations and ethics rules concerning the receipt of gifts, including university policies. Microsoft engaged with you without seeking promises or favoritism for Microsoft or any of its affiliates in any bidding arrangements. Further, no exclusivity will be expected from you, your institution, or its affiliates in consideration for this engagement.

I will be your main contact regarding Microsoft's financial support. If you have any questions regarding this gift, please feel free to contact me by e-mail at [kaneal@microsoft.com](mailto:kaneal@microsoft.com).

Sincerely,

A handwritten signature in blue ink that reads "Kathryn Neal".

Dr. Kathryn Neal  
Senior Director, University Relations

Microsoft Corporation is an equal opportunity employer.