UNIVERSITY OF MARYLAND EASTERN SHORE
Office of the President

March 17, 2025

Sanjay Rai, Ph.D.
Secretary of Higher Education
Maryland Higher Education Commission
6 N. Liberty Street, 10th Floor
Baltimore, Maryland 21201

RE: Substantial Change Proposal (Bachelor of Science degree in Mechanical Engineering)

Dear Secretary Rai:

The University of Maryland Eastern Shore hereby submits a substantial change proposal to begin offering a Bachelor of Science degree in Mechanical Engineering (BSME) within the School of Business and Technology.

Consistent with its mission, UMES seeks to expand its capacity to offer unique and/or critical certificate and degree programs. As such, UMES has developed a Bachelor of Science in Mechanical Engineering (BSME). This new program will be established in the Department of Engineering and will complement the university's undergraduate programs in Engineering by combining engineering physics, mathematics, and materials science to design, analyze, manufacture, and maintain mechanical systems. The proposed BSME program aims to offer prospective students the opportunity to pursue a Bachelor of Science degree in Mechanical Engineering, providing a pathway to a career that combines engineering and technology.

The proposed degree program will position UMES at the forefront of educational innovation in STEAM related academic programs. The proposed Mechanical Engineering program will go beyond the current General Engineering (mechanical specialization) program offered and will strengthen the workforce in the State of Maryland. It will also expand the pipeline of students entering the mainstream mechanical engineering field. Mechanical engineering remains in demand all over the world due to its versatile applications across various industries. The discipline's focus on designing, analyzing, and manufacturing mechanical systems makes it essential for sectors like automotive, aerospace, energy, robotics, and manufacturing. The proposed BSME program is expected to enable a stronger and multi-disciplinary research collaboration across the campus community, thus fueling research forward in many other disciplines beyond those created in applied science and engineering disciplines and creating a much broader impact on the Eastern Shore community as well as the State of Maryland.

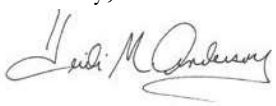
The UMES campus is in Somerset County, Maryland. The BSME will expand the educational opportunities for educationally disadvantaged students by developing a high-quality and innovative academic program that aligns with the educational needs of the region and the state of Maryland. The mission of the proposed program is to provide students and working professionals with advanced training in the discipline 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 are severely limited.

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

Thank you for your consideration.

Sincerely,



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

Copy: Dr. Rondall Allen, Provost and Vice President for Academic Affairs
Dr. Derrek Dunn, Dean, School of Business and Technology
Dr. Yuanwei Jin, Department Chair, Department of Engineering

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

Institution Submitting Proposal	University of Maryland Eastern Shore

Each action below requires a separate proposal and cover sheet.

- (●) New Academic Program
- ( ) New Area of Concentration
- ( ) New Degree Level Approval
- ( ) New Stand-Alone Certificate
- ( ) Off Campus Program
- ( ) Substantial Change to a Degree Program
- ( ) Substantial Change to an Area of Concentration
- ( ) Substantial Change to a Certificate Program
- ( ) Cooperative Degree Program
- ( ) Offer Program at Regional Higher Education Center

Payment Submitted: (●) Yes ( ) No
Payment Type: (●) R*STARS # JJ524288 ( ) Check # JJ524288
Payment Amount: $850
Date Submitted: 03-10-25

Department Proposing Program	Engineering and Aviation Sciences	
Degree Level and Degree Type	Bachelor of Science	
Title of Proposed Program	Mechanical Engineering	
Total Number of Credits	120	
Suggested Codes	HEGIS: 0911	CIP: 14.1901
Program Modality	(●) On-campus ( ) Distance Education (fully online) ( ) Both	
Program Resources	(●) Using Existing Resources ( ) Requiring New Resources	
Projected Implementation Date (must be 60 days from proposal submisison as per COMAR 13B.02.03.03)	(●) Fall ( ) Spring ( ) Summer	Year: 2025
Provide Link to Most Recent Academic Catalog	URL: http://catalog.umes.edu/index.php	
Preferred Contact for this Proposal	Name: Leesa Thomas Banks	
	Title: Interim Vice Provost of Academic Affairs	
	Phone: (410) 651-7591	
	Email: lpthomasbanks@umes.edu	
President/Chief Executive	Type Name: Heidi M. Anderson	
	Signature: Heidi M Anderson	Date: 03/17/2025
	Date of Approval/Endorsement by Governing Board:	

Revised 1/2021

Proposal for New Undergraduate Degree Program

Bachelor of Science in Mechanical Engineering (BSME)

A. Centrality to Institutional Mission Statement 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 Department of Engineering and Aviation Sciences proposes to establish a Bachelor of Science degree in Mechanical Engineering (BSME) within the School of Business and Technology (SBT) at UMES. Mechanical engineering is the study of physical machines that use force and movement. It combines engineering physics, mathematics, and materials science to design, analyze, manufacture, and maintain mechanical systems. Mechanical engineers work in many industries, including automotive, aerospace, biotechnology, computers, electronics, energy conversion, robotics, and automation. The proposed BSME program aims to offer prospective students the opportunity to pursue a Bachelor of Science degree in Mechanical Engineering, providing a pathway to a career that combines engineering and technology.

The program's curriculum includes core engineering courses, supporting science and math courses, major electives, and general education courses. This curriculum is designed to offer both a core understanding of traditional engineering disciplines, and an in-depth knowledge of the body. Our courses emphasize experimental and analytical coursework to gain a strong understanding of mechanical engineering technology and complex robotic systems.

The institution's mission of UMES, as an 1890 HBCU land-grant institution, is to promote distinctive learning, discovery and engagement opportunities in the arts and sciences, education, technology, engineering, agriculture, business and health professions. Central to this purpose is the guided interest in providing individuals, including first generation college students, access to a holistic learning environment that fosters multicultural diversity, academic success, and intellectual and social growth. The proposed program imbibes itself in this mission and it is guided by the opportunity to increase graduation rates of underrepresented minorities in the fields of mechanical engineering.

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

The proposed mechanical engineering degree program supports the institution's strategic goals. According to the UMES Strategic Plan 2023, (see the link https://wwwcp.umes.edu/president/strategic-plan/), we identified the following three goals under the Three Priorities:

- Priority 1: Academic Excellence and Innovation: "Goal 1.1: Attract, retain, and graduate more aspiring students at the undergraduate and graduate levels"

- Priority 2: Access, Affordability, and Achievement: "Goal 2.1: Increase Enrollment".
- Priority 3: Workforce and Economic Development: "Goal 3.3 Diversify and strengthen Maryland's knowledge workforce by expanding the pipeline of underrepresented minority students entering critical workforce fields (science technology engineering, aviation and mathematics (STEAM), cyber, health care, education, social work, human services, and technology)".

The proposed degree program will help the institution achieve its strategic goals listed above and position UMES to the forefront of educational innovation in STEAM related academic programs. The proposed Mechanical Engineering program is to go beyond the current General Engineering (mechanical specialization) program that we offer to students to diversify and strengthen the tech workforce for the State of Maryland and to expand the pipeline of underrepresented minority students entering the mainstream mechanical engineering field characterized by industry. According to Bureau of Labor statistics, nationwide, the overall employment of mechanical engineers is projected to grow 10 percent from 2022 to 2032, much faster than the average for all occupations. Thus, about 19,200 openings for mechanical engineers are projected each year, on average, over the decade. Mechanical engineering remains in demand all over the world due to its versatile applications across various industries. The discipline's focus on designing, analyzing, and manufacturing mechanical systems makes it essential for sectors like automotive, aerospace, energy, robotics, and manufacturing. Additionally, emerging fields such as renewable energy, sustainable design, and automation create new opportunities. Global demand for products and infrastructure also sustains the demand for mechanical engineers. The profession's adaptability and problem-solving skills ensure its continued relevance, making it a sought-after career choice nationwide and globally.

The proposed BSME program is expected to enable a stronger and multi-disciplinary research collaboration across the campus community, thus fueling research forward in many other disciplines beyond those created in applied science and engineering disciplines and creating a much broader impact on the Eastern Shore community as well as the State of Maryland.

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.

With the commission of the Engineering and Aviation Science Complex, a $103 million investment from the state, the proposed program will be supported by about two dozen state-of-the-art engineering laboratories such as the Robotics and Automation Lab, MEMS Lab with a class ISO 5 clean room, Fluid and Thermal Lab, Statics and Materials Lab, etc. One (1) new faculty member in ME will be recruited along with the existing four (4) faculty members in ME will be involved to support this proposed BSME program to develop courses and deliver instructions and labs. The new faculty line will be funded by the HBCU settlement fund that UMES receives for the first five years of program implementation. By leveraging the existing BS in General

Engineering program, we anticipate adequate resources for faculty lines and laboratories for instruction and research in the field of ME to ensure the success of this degree program.

4. **Provide a description of the institution's a commitment to:**
    a) **ongoing administrative, financial, and technical support of the proposed program**

The University Administration is committed to adequately funding this program and has designated it as one of the priority areas for expanding the institution's footprint. With the HBCU Lawsuit Settlement Fund, UMES, the School of Business and Technology, and the Department of Engineering and Aviation Sciences are equipped with the necessary resources and are committed to supporting the program in every way, including ongoing administrative, financial, and technical support.

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

This degree program is created by leveraging, in part, the existing faculty and staff in the Departments of Engineering and Aviation Sciences at UMES, as well as the state-of-the-art engineering laboratories in the Engineering and Aviation Science Complex on UMES campus. One (1) additional new full-time tenure-track faculty member with a terminal degree in the field of mechanical engineering or a closely related field will be recruited to develop and deliver courses and labs for the program. The university is fully committed to continuing the proposed BSME program for a sufficient period to allow enrolled students to complete the program.

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**

Mechanical engineering is the study of physical machines that involve force and movement. It's a branch of engineering that combines engineering physics, mathematics, and materials science to design, analyze, manufacture, and maintain mechanical systems. Mechanical engineers are problem solvers who apply their skills to design, develop, build, and test all sorts of mechanical devices, tools, engines, and machines in just about every type of industry. Mechanical engineers will work on teams to develop a wide range of products and systems including, transmissions, engine parts, aircraft engines, control systems, prosthetic devices, disk drives, printers, semiconductor tools, sensors, gas turbines, wind turbines, fuel cells, compressors, robots, machine tools, space shuttle vehicles, turbines, pumps, power plants, factories, and more.

The need for the advancement and evolution of mechanical technology demands academic programs such as the proposed BSME program to educate and produce next generation researchers and engineers to handle challenges in next generation technology evolution.

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

The UMES campus is in Somerset County, Maryland, one of the poorest counties in the state, according to the U.S. Census Bureau. Lack of educational opportunities and choices for minority and educationally disadvantaged students calls for development of high-quality and innovative academic programming to align academic programs with the educational needs of the region and the state of Maryland.

UMES currently offers the Bachelor of Science in General Engineering degree program in the Eastern Shore of Maryland. Mechanical specialization is one of the four specializations. Since the inception of the engineering program over the past 17 years there have been more than 160 graduates. Most of these students joined the technical workforce in industry, such as Lockheed Martin, Northrup Grumman, ASML, John Deere, etc. Among those graduates, more than a dozen former graduates are working in the Wallops Island area for NASA and its contractors. About two dozen or more have gone on to pursue graduate degrees (master's and doctorate) in electrical engineering, mechanical engineering, or engineering science at other engineering schools, including Dartmouth College, Rensselaer Polytechnical Institute, University of Maryland College Park, Old Dominion University, etc. The graduation and job placement data have demonstrated the success of the general engineering program at UMES.

However, over the course of the past ten years, based on the feedback from the graduates concerning their experiences during the job search process, we discovered that the nature of the General Engineering, its name and the curriculum, may have hindered them for landing jobs as opposed to those applicants who graduate with a mainstream degree such as Mechanical Engineering. To be explicit, General Engineering (Mechanical Specialization) is not the same as Mechanical Engineering from the viewpoint of some employers. By establishing a BSME degree program at UMES, we hope to remove the barrier for our graduates in entering the mechanical engineering workforce. Furthermore, we have established a Master of Science in Electrical and Mechatronics Engineering (MSEME) degree at UMES. The proposed BSME degree is expected to enable streamlined progression of our ME students to enroll in the MSEME program for graduate studies. We further anticipate that the established BSME program will facilitate transfer students with associate degrees in mechanical engineering from the community colleges.

The proposed mechanical engineering program is expected to further enhance UMES's position as a top choice higher education institution for STEM education for minority and educationally disadvantaged students in the state and the surrounding regions with the goal of developing a pipeline of engineering and STEM workforce for the state.

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

The proposed BSME program 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. In the State of Maryland, only Johns Hopkins University (JHU), University of Maryland College Park (UMCP), and University of Maryland Baltimore County (UMBC) offer Bachelor of Science in Mechanical Engineering degrees. However, all three institutions are located outside of the Eastern Shore region. The proposed BSME program at UMES will increase minority BSME degree grantees in the fields of mechanical engineering. It will also strengthen and expand the research capacity of UMES and provide high quality and unique educational programs at a high level.

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

The proposed BSME degree program is well aligned with the 2021-2025 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.

Mechanical engineers play key roles in a wide range of industries including automotive, aerospace, biotechnology, computers, electronics, microelectromechanical systems, energy conversion, robotics and automation, and manufacturing. The American Society of Mechanical Engineers (ASME) currently lists 36 technical divisions, from advanced energy systems and aerospace engineering to solid-waste engineering and textile engineering. The breadth of the mechanical engineering discipline allows students a variety of career options beyond the industries listed above. Regardless of the path they envision for themselves, a mechanical engineering education empowers students with creative thinking skills to design an exciting product or system; analytical tools to achieve their design goals; the ability to overcome all constraints; and the teamwork needed to design, market, and produce a system. These valuable skills can be applied to launch careers in many other fields, such as medicine, law, consulting, management, banking, and finance.

The proposed BSME degree program will provide equitable access and quality education to all Maryland residents, including those with disadvantaged backgrounds, to develop a strong mechanical engineering workforce for the state.

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

The practices and policies concerning the proposed BSME degree program align with all the existing policies at the University, which will ensure student success. By providing a carefully developed curriculum, sufficient engineering 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 BSME 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 and is to ensure that Historically Black Institutions are "competitive, both in terms of program and infrastructure", with Maryland's other state institutions. Ultimately, the proposed degree program will prepare highly qualified scientists and engineers to contribute to the economic growth and vitality of Maryland by providing them with new knowledge and skillsets in emerging technologies so they can obtain 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.

The role of a mechanical engineer is to take a product from an idea to the marketplace. To accomplish this, the mechanical engineer must be able to determine the forces and thermal environment that a product, its parts, or its subsystems will encounter; design them for functionality, aesthetics, and durability; and determine the best manufacturing approach that will ensure operation without failure. A BSME degree opens a plethora of opportunities across a broad spectrum of industries. For example, in the aerospace industry, mechanical engineers contribute to the design and testing of aircraft, spacecraft, and propulsion systems for companies like Boeing, SpaceX, or NASA; In the automotive industry, they work on vehicle design, engine development, and fuel efficiency improvements for manufacturers such as Ford, Tesla, or General Motors. Innovation in this area of engineering will no doubt continue in accordance with the development of technology - improving health care and patient outcomes in the process. The proposed BSME program will produce graduates in all these technical fields, expected as entry level engineers or engineering managers.

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

The 2023 median pay for mechanical engineers is $99,510 per year. Data by the Bureau of Labor Statistics (BLS) (https://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm) shows that overall employment of mechanical engineers is projected to grow 10 percent from 2022 to 2032, much faster than the average for all occupations. About 19,200 openings for mechanical engineers are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force.

A recent study on the job market for mechanical engineers in the US (https://www.careerexplorer.com/careers/mechanical-engineer/job-market/) shows that Maryland employed 5540 mechanical engineers in the industry, ranked 16th in the nation. This shows that Maryland has the potential to further increase the number of employment opportunities in the mechanical engineering field. The BLS predicts that most opportunities for mechanical engineers are in aerospace, automotive, biomedical, and construction industries.

Moreover, according to Occupational Information Network, i.e., O-Net Online, (https://www.onetonline.org/link/summary/17-2141.00), job titles suitable for graduates of the mechanical engineering program vary, such as Application Engineer, Design Engineer, Design Maintenance Engineer, Equipment Engineer, Mechanical Design Engineer, Mechanical Engineer, Process Engineer, Product Engineer, Project Engineer, Test Engineer. Perform engineering duties in planning and designing tools, engines, machines, and other mechanically functioning equipment. Oversee installation, operation, maintenance, and repair of equipment such as centralized heat, gas, water, and steam systems.

Among those position titles, industries with the highest concentration of employment in Mechanical Engineers are listed in the table below:
(https://www.bls.gov/oes/current/oes172141.htm)

Industry	Employment	Annual Mean Wage
Engine, Turbine, and Power Transmission Equipment Manufacturing	5,220	$111,630
Machinery Manufacturing	28,930	$93,900
Architectural, Engineering, and Related Services	58,810	$104,620
Metalworking Machinery Manufacturing	5,660	$84,820
Railroad Rolling Stock Manufacturing	670	$116,600

Finally, the Maryland Occupational Projections - Workforce Information and Performance had updated the projections of engineering jobs during a ten-year period of 2022-2032. It is anticipated that there will be an 8.43% increase of occupations in Architecture and Engineering in the state of Maryland. The proposed BSME program will help meet the demand of the engineering workforce.

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 employment data from the Bureau of Labor Statistics (BLS) is typically used to determine market demand. Data by BLS (https://www.bls.gov/ooh/architecture-and-engineering/mechanical-engineers.htm) shows that overall employment of mechanical engineers is projected to grow 10 percent from 2022 to 2032, much faster than the average for all occupations. About 19,200 openings for mechanical engineers are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force.

The career outlook for mechanical engineers is strong. Mechanical engineering features various specializations, from robotics to manufacturing to aerospace technology. As a result, it can offer numerous opportunities in industries ranging from automotive to energy production. Industry data shows (https://www.recruiter.com/careers/mechanical-engineers/outlook/) that the overall job outlook for mechanical engineer careers has been positive since 2004. Vacancies for this career have increased by 35.45 percent nationwide in that time, with an average growth of 2.22 percent per year. Demand for Mechanical Engineers is expected to go up, with an expected 34,750 new jobs filled by 2029. This represents an annual increase of 1.31 percent over the next few years.

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

Similar mechanical engineering BS programs that are offered by HBCUs in the region include: The University of District of Columbia and Howard University. In the State of Maryland, three institutions offer BSME degrees, The Johns Hopkins University, University of Maryland College Park, University of Maryland Baltimore County. Based upon data available to the public, the number of degrees awarded in BSME in the three Maryland institutions and other HBCUs in the region is summarized below:

Institutions	**# of ME BS Degree Awarded**
Johns Hopkins University	40 (2022-2023)
University of Maryland, College Park	360 (2022-2023)

University of Maryland Baltimore County	101 (2022-2023)
University of District of Columbia	20 (2022-2023)
Howard University	25 (2022-2023)

The data shows that the number of awarded BS degrees in mechanical engineering from HBCUs is still low. UMES is in a good position to address the shortage of HBCU graduates of a BSME program. UMES is thus uniquely positioned to address this need within the State of Maryland. It is our belief that the market demand is sufficiently high, the geographic draw of students is sufficiently distinct, the proposed BSME program to be offered in the Eastern Shore of the state, along with other similar programs in the state (e.g., JHU's BSME, UMD's BSME, and UMBC's BSME) will provide valuable contributions to the Maryland workforce.

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.**

The proposed program is unique and building upon the existing faculty expertise in the general engineering program at UMES. There is no other mechanical engineering degree program in the Eastern Shore of Maryland. Although other institutions in Maryland, such as University of Maryland College Park, University of Maryland Baltimore County, and the Johns Hopkins University offers a BSME degree program, these institutions are located about 130 miles away from the Eastern Shore. UMES serves a different geographical area compared with other parts or regions of the state. Moreover, the proposed program offers a unique curriculum with a focus in electronics, circuit design, artificial intelligence in which technical talents and workforce is seriously lacking, especially in the rural eastern shore of the state. The proposed UMES BSME program supplements other BSME programs offered in the state.

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

Mechanical engineers are in high demand and are essential to many industries, including transportation, healthcare, construction, robotics, aerospace, and artificial intelligence. Mechanical engineers create prosthetic limbs. They design new technology to improve food production, invent 3D printers and wireless chargers, and develop better water supplies. They even create robotic manufacturing plants. And yes, they also make fast cars, faster planes and even faster rockets. They do this all over the world, and almost every industry you can think of relies on mechanical engineering to thrive. That is why there is such a huge global demand for mechanical engineers, and why they're paid so well.

Mechanical engineering is one of the broadest engineering disciplines, and you may be surprised by the diversity of roles a mechanical engineer can take on. Excellent problem-solvers and communicators, mechanical engineers excel at breaking complicated subjects down into easily digestible information. This is why they so often take on leadership roles, such as project manager or business executive, or are snatched up by management consulting firms. Designing and producing a product that adds value to a person's life is one thing. Articulating how it does so is something else entirely.

UMES, as a part of the national research community, will join collaborate with other HBCUs in the race to produce a qualified technical workforce. The BSME program we propose will enable mechanical engineering students to obtain both foundational and practical knowledge in various aspects of mechanical system design and testing. As we can imagine, BSME graduates of UMES, will play a pivotal role in bridging the diversity gap within the engineering landscape while fostering a generation of talented, diverse and innovative engineers poised to shape the future of industries in the region, the state of Maryland, and worldwide.

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.

Engineering programs with various sub-disciplinary areas have always been in high demand on the employment spectrum. Among the four HBIs in the state of Maryland, no mechanical engineering (BS) degree program is offered. The proposed BSME program at UMES, if established, will position UMES as a center for medical technology education and research in the rural area of Eastern Shore. The program will enable UMES to produce a pipeline of high caliber workforce in mechanical engineering to support manufacturing facilities and other industry fields such as aerospace and automotive.

F. Relevance to the identity of Historically Black Institutions (HBIs)

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

UMES has envisioned a strong presence in education and innovation in the STEAM field, and engineering is one of the focus areas. The proposed BSME program at UMES, if established, will strengthen the position of UMES as a center for engineering education and research in the rural area of the Eastern Shore, and thus reaffirming the mission of UMES as an 1890 land grant institution. The program will enable UMES to produce a pipeline of high caliber

workforce in mechanical engineering to support the high demand of tech workforce in the region and the state.

G. Adequacy of Curriculum Design, Program Modality, and Related Learning Outcomes (as outlined in COMAR 13B.02.03.10):

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

Curriculum Design: The proposed program was established through a rigorous review of unmet needs by the institution. It started from the faculty in the engineering program, with approval from the Departmental Curriculum Committee, School Curriculum Committee, Graduate Faculty Council, Senate Curriculum Committee, etc. The curriculum was developed by the faculty in the Department of Engineering and Aviation Sciences.

Faculty Oversight: The courses of the curriculum in the proposed BSME degree program will be taught by faculty in the Department of Engineering and Aviation Sciences. One (1) new full-time tenure-track faculty member with a Ph.D. degree in the mechanical engineering field will be recruited. The new faculty member is expected to develop courses and labs and deliver teaching and research, in addition to the existing four Mechanical Engineering faculty in the department will also help with the Engineering program because the majority of courses in the core and electives of the BSME curriculum are the same as courses in the existing Engineering Program curriculum. This arrangement ensures the new BSME program is fully supported in terms of faculty resources. Please see the detailed list of ME faculty background in the current engineering program.

Program Modality: The program will be offered at the main campus of UMES.

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

To ensure the curriculum of the BSME program reflects the rigor and highest standards appropriate to the mechanical engineering field, we will seek and maintain accreditation from the Engineering Accreditation Commission (EAC) of ABET, https://www.abet.org, under the commission's General Criteria and the Program Criteria for Mechanical Engineering for this BSME program.

The educational objectives of the curriculum of the proposed BSME program are to enable graduates of the program to develop the ability of:

- Applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations), and statistics;
- Solving bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems;

- Analyzing, modeling, designing and realizing bio/biomedical engineering devices, systems, components, or processes; and
- Making measurements on and interpreting data from living systems.

The learning outcomes of the program align with the learning outcomes of the ABET (1)-(7) specified by the Engineering Accreditation Commission (EAC).

- [1]. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics;
- [2]. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economics factors;
- [3]. An ability to communicate effectively with a range of audiences;
- [4]. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts;
- [5]. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives;
- [6]. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions;
- [7]. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Students will learn analytical and experimental methods that are broadly applicable in the field of biomedical engineering. They will also be given specific instruction and hands-on laboratory experimental leaning experiences on how to apply these methods to a large range of problems in biomedical engineering.

3. Explain how the institution will:

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

Assessment Methods based on established departmental standards will include the following:

- Assessing written and oral student presentations, written assignments and research projects.
- Evaluating student performance in exams, quizzes and assignments in required major courses.
- Assessing comprehensive senior design project reports in the two tracks of the program.

b) document student achievement of learning outcomes in the program

The department will document student achievement of the learning outcomes in the program in the same fashion as its current accredited engineering undergraduate program. Assessment of learning outcomes will be conducted every six years per ABET accreditation requirements.

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

The Mechanical Engineering BS program consists of **120** total credit hours. The number of credits is determined based upon the MHEC requirement for BS degree and a survey of credit requirement for similar mechanical engineering programs in the region. The curricula include 28 credit hours of general education courses in English, arts and humanities, social and behavioral sciences, and emerging issues. An additional 11 credits in mathematics and physical sciences are required under the General Education program, which are included as a part of the requirements for the Mechanical Engineering major. This makes the total credits for General Education to be 39 credit hours. The Mechanical Engineering curriculum also requires 19 credits of supportive math and physics courses. Students take 54 credit hours of core mechanical engineering courses. Students choose 6 credit hours of elective courses. The program is on a semester basis. The total number of credits and their distribution is given as follows:

	Category	***Distribution***
I.	General Education Courses	39 credit hours
II.	Supportive Math & Science Courses	19 credit hours
III.	Mechanical Core Courses	54 credit hours
IV.	Elective Courses	8 credit hours

Mechanical Engineering Core Requirement		**54 credits needed**
Course Code	**Course Title**	**Credit Hours**
ENGE 150	Modern Engineering Design	3 hrs
ENGE 170	Programming Concepts for Engineers	3 hrs
ENGE 240	Basic Circuit Theory	3 hrs
ENGE 241	Analog Circuit Lab	1 hrs
ENGE 260	Statics	3 hrs
ENGE 261	Dynamics	3 hrs
ENGE 270	Computer Aided Design	3 hrs
ENME 325*	Properties of Materials	3 hrs
ENGE 320	Statistics and Probability for Engineers	3 hrs
ENME 342	Fluid Mechanics	3 hrs
ENME 345	Thermodynamics	3 hrs
ENGE 370	Computational Methods in Engineering	3 hrs
ENME 346	Heat Transfer	3 hrs

ENME 347*	Thermal and Fluid Lab	1 hrs
ENGE 362	Mechanics of Materials	3 hrs
ENME 363*	Properties and Mechanics of Materials Lab	1 hrs
ENGE 382	Control Systems	3 hrs
ENGE 380	Instrumentation	3 hrs
ENGE 383	Control Lab	1 hrs
ENGE 475	Engineering Seminar	1 hrs
ENGE 476	Senior Design Project I	2 hrs
ENGE 477	Senior Design Project II	2 hrs

Mechanical Engineering Elective		**8 credits needed**
Course Code	**Course Title**	**Credit Hours**
ENAE 420	Aerodynamics	3 hrs
ENME 422	Mechanism and Machine Design	3 hrs
ENME 425	Rapid Prototyping and Product Development	3 hrs
ENME 430	Finite Element Analysis	3 hrs
ENME 440	Mechatronics	3 hrs
ENME 442	Micro Electro-Mechanical Systems	3 hrs
ENME 462	Digital Control System	3 hrs
ENAE 467	Design of Autonomous Aerial Systems	3 hrs
ENME 470*	Vibrations	3 hrs
ENME 468	Robotics	3 hrs
ENME 365*	Machine Element Design	3 hrs
ENME 472	Selected Topics in Engineering	3 hrs

Supportive Science & Math Requirement		**19 credits needed**
Course Code	**Course Title**	**Credit Hours**
MATH 211	Calculus II	4 hrs
MATH 212	Calculus III	4 hrs

MATH 241	Differential Equation for Engineers	3 hrs
PHYS 262	General Physics II	3 hrs
PHYS 264	Genera Physics II Lab	1 hrs
PHYS 263	General Physics III	3 hrs
PHYS 265	General Physics III Lab	1 hrs

Note: ENME 325, ENME 347, and ENME 363 are new courses introduced to the major core of the BSME curriculum, ENME 365 and ENME 470 are new courses introduced to the electives of the BSME curriculum. The remaining courses can be found in the UMES catalog (http://catalog.umes.edu/).

The list of new courses in the mechanical engineering program, including core courses and electives, along with their titles, semester credit hours, and course descriptions, is provided below.

Course Descriptions for Mechanical Core:

ENGE 150 Modern Engineering Design (3 credits). An introduction to modern engineering design with emphasis on various aspects of developing a product via hands-on design approach, communication skills, and teamwork; use of product visualization and computer software such as word processing, power point, and spreadsheet; students work as teams to develop and design a working prototype. Prerequisite: MATH 109 College Algebra.

ENGE 170 Programming Concepts for Engineers (3 credits). Introduction to algorithms; overview of computers and programming; principles of software development; high level languages; C-programming; input/output; data types and variables; operators and expressions; selection structure; repetition; functions; arrays; pointers; strings; structure data types; linked list; stream and file management; debugging and documentation. Prerequisite: ENGE 150 Modern Engineering Design.

ENGE 240 Basic Circuit Theory (3 credits). The course focuses on basic circuit elements, resistors, capacitors, inductors, independent and dependent sources, and operational amplifier; Kirchhoff's laws; nodal and mesh analysis; superposition; Thevenin and Norton theorems; DC and AC steady state analysis; Transient analysis for first and second order circuits; and phasors. Prerequisite: MATH 211 Calculus I; Co-requisite: MATH 241 Differential Equations for Engineers, ENGE 241 Analog Circuit Lab.

ENGE 241 Analog Circuit Lab (1 credit) Introduction to basic measurement techniques and electrical laboratory equipment, power supplies, oscilloscopes, multi-meters, and function generators; experiments concerning principles taught in ENGE 240 Basic Circuit Theory course. Prerequisite: MATH 211 Calculus I; Co-requisite: ENGE 240 Basic Circuit Theory.

ENGE 260 Statics (3 credits) This course covers addition, subtraction, and multiplication of force and moment vectors; equilibrium of particles, planar, and 3-dimensional rigid bodies under the action of forces and moments; applications of equilibrium principles to simple trusses, frames, and machines; center of mass and centroids; moments of inertia; internal forces and moments; shear force and bending moment diagrams. Prerequisite: MATH 112 Calculus I.

ENGE 261 Dynamics (3 credits) This course covers kinematics and kinetics of particles and rigid bodies; relative motion, force acceleration, work energy, and impulse momentum relationships in Cartesian, normal tangential, polar, spherical, and cylindrical coordinate systems; introduction to design analysis involving dynamics principles. Prerequisite: MATH 211 Calculus II and ENGE 260 Statics.

ENGE 270 Computer Aided Design (3 credits) Introduction to 3-D solid modeling, engineering drawings, assembly modeling and computer animation based on parametric feature-based CAD systems such as SolidWorks along with an overview on main geometric modeling theoretical concepts behind commercial CAD systems. Prerequisite: ENGE 150 Modern Engineering Design.

ENME 325 Properties of Materials (3 credits) This course explores the fundamental properties of engineering materials, including metals, polymers, ceramics, and composites. Topics include the relationship between material structure, processing, and properties; mechanical, thermal, and electrical behavior of materials; failure mechanisms such as fatigue, creep, and fracture; and material selection for engineering applications. The course emphasizes the practical application of material science principles in the design and analysis of engineering systems. Prerequisite: CHEM 111 (General Chemistry) and PHYS 161 (General Physics I)

ENGE 320 Statistics and Probability for Engineers (3 credits) Probability; random variables and processes; discrete and continuous distributions and densities; collection and presentation of sample data; frequency distributions and histograms; confidence intervals; hypothesis testing; basic problems of statistical inference; linear regression and correlation; designing engineering experiments. Prerequisite: MATH 211 Calculus II

ENME 342 Fluid Mechanics (3 credits) Fluid properties; fluid statics; conservation of mass, momentum, and energy in control volumes; steady and unsteady Bernoulli's equation; differential analysis of fluid flow; dimensional analysis and similitude; Introduction to laminar and turbulent flow; Introduction to boundary layers; lift and drag. Prerequisite: MATH 241 Differential Equations for Engineers and ENGE 261 Dynamics

ENME 345 Thermodynamics (3 credits) Work and heat transfer; the study of classical thermodynamics approach to closed systems and control volumes; properties and processes of gases and vapors; zeroth, first, and second laws of thermodynamics for closed systems and control volumes; entropy; thermodynamic power and refrigeration/heat pump cycles. Prerequisite: ENGE 261Dynamics.

ENGE 370 Computational Methods in Engineering (3 credits) Fundamentals of linear algebra and basic operations of vectors and matrices; error analysis; solution of a system of linear

equations; iterative solution of nonlinear equations; numerical integration; numerical solution of differential equations; introduction to Matlab software; programming and applications relating to the computational functions in Matlab. Prerequisite: MATH 211 Calculus II; Co-requisite: MATH 241 Differential Equations for Engineers.

ENME 346 Heat Transfer (3 credits) This course exams conduction, convection, radiation, heat storage, energy conservation, steady-state/transient conduction, thermal circuit modeling, multidimensional conduction, surface radiation properties, enclosure radiation exchange, surface convection/fluid streams over objects, non-dimensional numbers, laminar, turbulent, thermobuoyant flow, boiling and condensation and heat exchangers. Prerequisite: ENME 342 Fluid Mechanics.

ENME 347 Thermal and Fluid Lab (1 credits) This laboratory course provides hands-on experience in the experimental study of thermodynamics and fluid mechanics principles. Students will conduct experiments related to heat transfer, fluid flow, energy conservation, and system performance. Emphasis is placed on experimental design, data acquisition, error analysis, and the interpretation and presentation of results. The course reinforces theoretical concepts through practical application in engineering systems. Prerequisite: ENME/ENAE 342 Fluid Mechanics; Co-requisite: ENME 345 Thermodynamics (Note ENME 346 Heat Transfer is to be offered at the same time)

ENGE 362 Mechanics of Materials (3 credits) Students will be introduced to stress, strain, materials properties, and Hooke's law; distortion of engineering materials in relation to changes in stress or temperature; torsion of circular rods and tubes; bending and shear stresses in beams; deflection of beams; thin wall pressure vessels; combined loading; stress and strain transformation; buckling of columns; engineering applications. Prerequisite: MATH 211 Calculus II and ENGE 260 Statics.

ENME 363 Properties and Mechanics of Materials Lab (1 credits) This laboratory course provides practical experience in testing and analyzing the mechanical and physical properties of engineering materials. Experiments include tensile, compression, hardness, and impact testing, as well as microstructure examination and fracture analysis. Students will learn to apply fundamental concepts of material behavior, use modern testing equipment, analyze experimental data, and prepare technical reports. Prerequisite: ENME 325 (Properties of Materials), Co-Requisite: ENGE 362 (Mechanics of Materials)

ENGE 382 Control Systems (3 credits) This course covers mathematical models of control system; Laplace transform; signal flow graph; frequency and time domain characteristics of the system response; methods of linear control system analysis and designs, root locus, Bode, and Nyquist plots; stability theory; design specifications in time and frequency domains; compensator design; PID controller design. Prerequisite: MATH 241 Differential Equations for Engineers and ENGE 261 Dynamics; Co-requisite: ENGE 383 Control Lab.

ENGE 380 Instrumentation (3 credits) Principles of measurement and instrumentation; transduction and calibration; noise measurement and signal conditioning; data acquisition, recording, and presentation; sensor selection to measure temperature, pressure, flow, level, force, and torque; transducers to measure translational displacement, velocity, acceleration, and vibration; rotational displacement, velocity, and acceleration measurement; sensor application to measure different physical phenomena. Prerequisite: ENGE 240 Basic Circuit Theory; Co-requisite: ENGE 340 Analog and Digital Electronics.

ENGE 383 Control Lab (1 credits) This laboratory course provides practical hands-on training and experience with methods used in modeling, analysis, simulation, and control of engineering systems. Laboratory experiments cover topics taught in ENGE 382 Control Systems course. MATH 241 Differential Equations for Engineers and ENGE 261 Dynamics; Co-requisite: ENGE 382 Control Systems.

ENGE 475 Engineering Seminar (1 credits) This is a general seminar course that covers current topics in engineering. Prerequisite(s): Permission of instructor and Senior Standing.

ENGE 476 Senior Design Project I (2 credits) Students are introduced to a design project to demonstrate their ability to engage in the practice of engineering as a profession. Students in consultation with the supervising professor and course coordinator must identify and implement a design project. The topic may be analytical, numerical, experimental, or field-oriented, utilizing knowledge gained from academic and research experiences integrated in the curriculum. Use of professional engineering standards and a design approach are required. Prerequisite(s): Senior standing and permission of instructor. A written proposal, literature search, and an oral presentation are required. Prerequisite: Senior Standing and Permission of Instructor

ENGE 477 Senior Design Project II (2 credits) This course is a continuation of ENGE 476 Senior Design Project I, with the same standards and requirements. Prerequisite(s): ENGE 476. A progress report, a final report, and an oral presentation are required.

Course Description for Mechanical Electives:

ENAE 420 Aerodynamics (3 credits) Introduction to aerodynamics fundamental concepts such as lift, drag, moment, pressure distribution, boundary layers; potential theory of bodies; airfoil theory and applications; finite wing theory and applications; introduction to Navier-Stokes equations; laminar boundary layers; turbulent boundary layers; instability and turbulence/separation; introduction to airfoil design. Prerequisite: ENME 342 Fluid Mechanics.

ENME 422 Mechanism and Machine Design (3 credits) Kinematic and dynamic analysis of motion of linkages, cams, and gears/gear trains; synthesis and analysis of motion in machines; visualizing motion in mechanisms and machinery using simulation software environments; exploration of machine/mechanism design solution for specified requirements. Prerequisite: ENGE 261 Dynamics, ENGE 370 Computational Methods for Engineering.

ENME 425 Rapid Prototyping and Product Development (3 credits) Introduction to rapid prototyping; product development process; materials for rapid prototyping; CAD solid model interaction with rapid prototyping systems; applications of rapid prototyping technologies to product development and design; rapid tooling process, rapid manufacturing process; reverse engineering. Prerequisite: ENGE 270 Computer Aided Design and ENGE 362 Mechanics of Materials.

ENME 430 Finite Element Analysis (3 credits) Introduction to finite element method and application; relations between stresses, strains, displacements, temperature and material properties; discretization and meshing; force vector, displacement vector, stiffness matrix, assembly process, solution techniques; truss elements, beam elements; triangular and quadrilateral elements; iso-parametric formulation; plane stress and plane strain applications; penalty and Lagrangian methods; software applications. Prerequisite: ENGE 270 Computer Aided Design, ENGE 362 Mechanics of Materials.

ENME 440 Mechatronics (3 credits) Physical and mathematical modeling of mechanical, electrical, electromechanical, thermal, fluid, and multidisciplinary physical systems; sensors and electronics for measurements of system; embedded/external feedback control using conventional and intelligent control algorithms; computer aided engineering tools for mechatronic system design and analysis; practical applications using mechatronic devices. Prerequisite: ENGE 370 Computational Methods in Engineering, ENGE 382 Control Systems.

ENME 442 Micro Electro-Mechanical Systems (3 credits) Basic integrated circuit manufacturing processes; electronics devices fundamentals; microelectromechanical systems fabrications including surface micromachining, bulk micromachining, and lithography; introduction to micro-actuators and microsensors such as micromotors, grippers, accelerometers and pressure sensors; physics of MEMS, scaling law, heat transfer, mechanics, electrostatics; introduction to micro-fluid systems; mechanical and electrical issues in micromachining; packaging techniques; CAD tools to design microelectromechanical structures. Prerequisite: ENGE 380 Instrumentation.

ENME 462 Digital Control System (3 credits) Introduction to techniques for the analysis and design of digital control systems; linearization; difference equations; z-transforms; design of linear controllers; digital implementation of control systems. Prerequisite: ENGE 382 Control Systems.

ENME 365 Machine Element Design (3 credits) This course focuses on the analysis and design of mechanical components commonly used in engineering systems. Topics include stress and failure analysis, fatigue, material selection, and the design of components such as shafts, bearings, gears, fasteners, and springs. Students will apply principles of mechanics, materials, and manufacturing to develop safe and efficient designs, emphasizing the use of design standards and computational tools in solving real-world engineering problems. Prerequisite: ENGE 362 (Mechanics of Materials) and ENGE 261 (Dynamics)

ENME 464 Embedded System Design Lab (2 credits) Fundamentals of embedded system hardware and firmware design are the focus of this course. Students will also learn embedded processor selection, hardware/firmware partitioning; architecture and instruction sets of a microcontroller, firmware architecture, design, and debugging, circuit design, layout, and debugging; development tools and a set of design experiments utilizing a popular microcontroller for practical applications. Prerequisite(s): ENGE 383 Control Lab.

ENAE 467 Design of Autonomous Aerial Systems (3 credits) Introduction to unmanned aerial vehicles, manned and unmanned aircraft design; conceptual unmanned aerial vehicles design based on concepts drawn from airplane aerodynamics, aircraft structure, stability and control, propulsion and compressible flows, navigation, guidance, communication, and design of control sensors; design for efficiency, design for performance, design for stability; introduction to ground, wind tunnel and flight testing. Prerequisite: ENAE 420 Aerodynamics.

ENME 470 Vibrations (3 credits) This course provides a comprehensive introduction to the principles and applications of mechanical vibrations. It focuses on modeling, analysis, and design of vibrating systems, emphasizing single and multi-degree-of-freedom systems. Topics include Free and forced vibrations for undamped and damped systems. Single Degree of Freedom Systems: Equations of motion, natural frequencies, and response to various excitations. Multi-Degree of Freedom Systems: Normal modes, eigenvalues, and eigenvectors. Continuous Systems: Vibration of strings, rods, beams, and plates using partial differential equations. Damping: Material and structural damping mechanisms and their effects. Energy methods and numerical methods. Applications for engineering systems. Prerequisite: ENGE 261 Dynamics

ENME 468 Robotics (3 credits) 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. Prerequisite: ENGE 382 Control Systems and ENGE 370 Computational Methods in Engineering

ENME 469 Robotics and Automation Design Lab (2 credits) This course involves laboratory experiments to design and develop flexible automation systems utilizing robot manipulators based on topics covered in ENME 468 Robotics course. Prerequisite(s): ENME 468 Robotics.

ENME 472 Selected Topics in Engineering (3 credits) Selected topics on special or current topics and issues relating to engineering structured for students in engineering and other areas. Prerequisite: Permission of Instructor

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

Students in the mechanical engineering program will take a total of 39 credits of general education courses. This includes 28 credit hours of general education courses in English, arts and humanities,

social and behavioral sciences, and institution-specific courses, including First-Year Experience, Computer Literacy, and JEDI (Justice, Equity, Diversity, Inclusion). An additional 7 credits in biological and physical sciences and 4 credits in mathematics (Calculus I) are also required for the program. The total number of general education credits (39) and the composition of the Gen Ed courses meet the requirements of the university Gen Ed program and the engineering program curriculum.

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

As with the current undergraduate General Engineering degree program at UMES, we will seek to have the proposed Mechanical Engineering program accredited by the Accreditation Board of Engineering and Technology (ABET). The criteria for accrediting a Mechanical Engineering program are stipulated in two areas [Link to ABET Criteria]:

A. **I. General Criteria for Baccalaureate Level Programs, Criteria 5 Curriculum,** and

B. **III. Program Criteria for Mechanical and Similarly Named Engineering Programs**

Under ABET's **Criteria 5 Curriculum**, "The curriculum must include experience in:

> one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.
>
> one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. Engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet these stated needs.

Under ABET's **Program Criteria for Mechanical Engineering**, "The curriculum must include:

a. principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations);

b. applications of these topics to modeling, analysis, design, and realization of physical systems, components or processes;

c. coverage of both thermal and mechanical systems; and

d. in-depth coverage of either thermal or mechanical systems.

Here we provide an analysis of the proposed credits in each of the categories for the curriculum.

Category		Distribution	Explanation
I.	General Education	39 credit hours	This section includes credits of basic science and math courses, in particular, Chemistry (or Biology), Physics 1/Lab, and Calculus 1.
II.	Supportive Math and Sciences	19 credit hours	Per ABET program criteria, a minimum of 30 credits are required. Here, we have 19 credits in Math and Physics. The rest of the credits are in the Gen Ed section.
III.	Engineering Core Courses	54 credit hours	Per ABET program criteria, a minimum of 45 credits are required. This section includes core and elective courses in mechanical engineering subjects.
IV.	Elective Courses	8 credit hours	
	TOTAL	**120**	

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

No other institution or non-collegiate organization is required to offer this degree program.

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.**

The entire curriculum and course specific information of the proposed degree program will be posted on the Department of Engineering and Aviation Science website:www.umes.edu/engavi. Information pertaining to the availability of academic/student support services, financial aid resources and tuition payment policies can be found on the webpages of the UMES Office of Admissions and the Office of Financial Aid.

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.**

The program will be advertised alongside other 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. The Department has a tradition of strong outreach program. For example, the Department has hosted in the past three years the "National Engineer's Week" (in the month of February each year) celebration for high schools from the local counties, such as Wicomico County, Somerset County, etc. Faculty with different disciplines in engineering developed hands-on activities to enable high schools to have firsthand exposure to different engineering disciplines. We will continue this engagement as an effort of advertising, recruiting and promoting engineering education.

H. Adequacy of Articulation

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

This is a new program to be established at UMES home campus. UMES has existing articulation agreements with community colleges in the state, such as Wor-Wic Community College, and high schools. UMES has an umbrella agreement with Wor-Wic Community College for various Bachelor of Science degree programs at UMES. We plan to add the proposed BSME program to the current list of UMES articulation agreements. The provisional agreement has been attached to this proposal. Furthermore, we have established an agreement with Somerset County Public Schools to align their Project Lead the Way (PLTW) course with the "ENGE 150 Modern Engineering Design" credits, which are part of the BSME program. This agreement is attached to this proposal. Going forward we will leverage the existing partnerships to develop new articulation agreements with high schools in the local counties and community colleges for the proposed BSME program.

I. Adequacy of Faculty Resources (as outlined in COMAR 13B.02.03.11).

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 faulty member will teach in the proposed program.**

One (1) new faculty line has been allocated to support the proposed BSME degree program by the HBCU settlement fund. Furthermore, the existing faculty in the engineering program will also be able to provide needed expertise to support partially the teaching of courses. There are four (4) full-time engineering faculty qualified to teach the mechanical engineering core and elective courses cross-listed in the proposed BSME curriculum and the existing general engineering curriculum.

Existing four (4) faculty with expertise in Mechanical/Aerospace Engineering are listed below:

Dr. Payam Matin, **Professor**. He received his Ph.D. in Mechanical Engineering from Oakland University, Rochester, Michigan. His research has been in the areas of computational mechanics and experimental mechanics with applications in solid mechanics, structural design, plasticity, and sheet metal forming, drone design, etc.

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

Dr. Lanju Mei, **Associate Professor**. She received her Ph.D. degree in Aerospace and Mechanical Engineering from Old Dominion University. Her primary research interests include MEMS sensor, additive manufacturing, and computational fluid dynamics.

Dr. Aaron Persad, **Assistant Professor**. He received his Ph.D. degree in Mechanical Engineering from the University of Toronto. Prior to joining UMES, he was with Massachusetts Institute of Technology. His research is in space sciences, specifically focusing on bioastronautics (human-tended research and space suits), low-gravity experiments and payload development, non-equilibrium statistical thermodynamics (such as quantum mechanics to describe bulk-scale phase-change processes), and nanotechnology.

Furthermore, a new full-time tenure-track faculty member in mechanical engineering is expected to be recruited to assist the program. To further demonstrate the qualification and the role of the faculty in delivering the instructions of the BSME program, we list the individual faculty members and the major courses (code with ME or AE) that align with their expertise:

ME/AE major or elective courses	**Matin**	**Nagchaudhuri**	**Mei**	**Persad**	**New Faculty (expected)**
ENME 325	X		X	X	
ENME 342			X	X	
ENME 345		X	X		
ENME 346			X	X	
ENME 347			X	X	
ENME 363	X				X
ENME 365		X			
ENME 422		X			
ENAE 420			X	X	
ENME 425	X				
ENME 430	X				

ENME 440				X	
ENME 462	X	X			
ENME 442				X	
ENAE 467			X		
ENME 470	X				X
ENME 468		X			

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

    b) The learning management system

(a) and (b): Faculty support for the development and instruction of courses is provided by the Center for Teaching Excellence at UMES. The department also supports faculty professional development for attending conferences such as American Society of Mechanical Engineers (ASME) and ASEE (American Society of Engineering Education) for pedagogy training in engineering education, as well as ABET Symposium for continuous improvement.

Canvas LMS is the current learning management system utilized by UMES throughout the campus. Canvas represents an important development in improving the student experience at UMES, providing valuable new tools for our faculty and supporting students in an impressive digital environment. For faculty, the Center for Instructional Technology & Online Learning (CITOL) https://wwwcp.umes.edu/citol/ 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, YuJa, etc.

d) Evidenced-based best practices for distance education, if distance education is offered.

Not applicable.

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 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 ASME Digital Collection, the IEEE Digital Library IEEE Explore, the technical papers could be accessed through the Inter-Library 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.**

The UMES department of Engineering and Aviation Sciences is housed in the Engineering and Aviation Science Complex, a 166,000 square feet facility that houses more than 20 engineering laboratories. They include Robotics Lab, Fluid/Thermal lab, Materials lab, Aerospace lab, Electronics Lab, Circuits Lab, Micro-Electro-Mechanical Systems (MEMS) Lab with a Clean Room (ISO Class 5, 6 and 7), Control System Lab, and Embedded System Lab, Fluid and Thermal Lab, Microwave Chamber, CAD/VLSI Lab, High Bay Area, and Multiple Computer Labs, etc. These labs can support majority of the activities in the new courses and research activities. A complete list of engineering labs with brief descriptions is shown by the link:

https://wwwcp.umes.edu/engineering/engineering-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.

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**

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

(a) and (b): Faculty support for the development and instruction is provided by the Information Technology Department and Academic Computing Unit professionals. Consultation is available for issues such as instructional design, software development, educational research, etc. These technologies and opportunities ensure students enrolled in and faculty teaching have adequate access to leaning resources.

Canvas LMS is the current learning management system utilized by UMES throughout the campus. For faculty, the Center for Instructional Technology & Online Learning (CITOL) https://wwwcp.umes.edu/citol/ 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.

L. Adequacy of Financial Resources with Documentation (as outlined in COMAR 13B.02.03.14)

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[1]	$0.00	$0.00	$0.00	$0.00	$0.00
2. Tuition/Fee Revenue[2] (c+g below)	$139,068.00	$275,400.00	$411,730.00	$548,064.00	$694,396.00
a. # FT Students	15	30	45	60	75
b. # Annual Tuition/Fee Rate	$8,724.00	$8,724.00	$8,724.00	$8,724.00	$8,724.00
c. Annual / Full Time Revenue (a x b)	$130,860.00	$261,720.00	$392,580.00	$523,440.00	$654,300.00
d. # PT Students	3	5	7	9	11
e. Credit Hour Rate	$228.00	$228.00	$228.00	$228.00	$228.00
f. Annual Credit Hours	12	12	12	12	12

g. Total Part Time Revenue (d x e x f)	$8,208.00	$13,680.00	$19,150.00	$24,624.00	$30,096.00
3. Grants, Contracts & Other External Sources[3]	$0.00	$0.00	$0.00	$0.00	$0.00
4. Other Sources	$0.00	$0.00	$0.00	$0.00	$0.00
TOTAL (Add 1 - 4)	$139,068.00	$275,400.00	$411,730.00	$548,064.00	$694,396.00

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)	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
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	50,000	0	0	0	0
TOTAL (Add 1 - 7)	50,000	0	0	0	0

Narrative Rationale for Table 1: Resources

1. Reallocated Funds
   No funds will be reallocated from existing programs.

2. Tuition and Fee Revenue
   We assume that tuition and fees will remain unchanged for the next five years. The annual in-state tuition rate is $8724 for full-time students. For part-time students, the credit hour rate is $228/credit. The two values were used in calculating the revenue for full-time students and 6 credits per semester (i.e., 12 credit per year) for part-time students.

3. Grants and Contracts
   No additional sources of funding are expected currently.

4. Other Sources
   No additional sources of funding are expected currently.

5. Total Year: 5-year estimate is provided.

Narrative Rationale for Table 2: Expenditures

1. Faculty (# FTE, Salary and Benefits)

   No additional faculty line is required. The Department is currently conducting a national search for one (1) new full-time, tenure-track faculty member with a terminal degree in mechanical engineering or a closely related field. The position is expected to be filled by

Fall 2025 to support the BSME Program. The position is funded by the HBCU Settlement Fund.

2. Support Staff (# FTE, Salary and Benefits)

   No additional staff line is required. The Department is currently conducting a national search for one (1) Engineering Lab (Machine) Specialist. The position is expected to be filled by Fall 2025 to support the operation of the mechanical laboratories in the Engineering and Aviation Science Complex. The position is funded by the HBCU Settlement Fund.

3. Equipment
   Not requested.

4. Library
   Minimal funds are needed to purchase additional engineering textbooks.

5. New and/or Renovated Space
   Not needed

6. Other Expenses
   $50,000 Startup Package for each new hire at the rate of $50,000 per person. A total of $50,000 is requested. The startup package is to support new faculty, especially at the assistant professor level, for professional development, including developing proposals for grants and contracts, travel and supplies for specialized engineering labs.

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.**
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.**

1 and 2:

UMES 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 and analyzed, and results are used to improve course curriculum and pedagogy.

Once the program is launched, its courses will enter the course evaluation system. Teaching evaluations ask 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.

In addition, every faculty is evaluated each year. The evaluation process includes an assessment of faculty teaching, faculty research record and productivity, and school-wide and department service. To receive a meritorious evaluation, a faculty member must demonstrate effective teaching, active scholarly activities and publication, etc. There is also a provision for the administration to develop an improvement plan for faculty members who have not done well in teaching. Tenured faculty will undergo a five-year post-tenure review.

Periodic academic program review takes place in a cycle of every seven years. Data regarding program enrollment, retention and graduation rates are collected by the Office of Decision Science and Visualization in conjunction with the program coordinator. The data are analyzed against program outcomes and results are used to improve the program.

The program accreditation comprehensive review takes place every six years per ABET criteria. The assessment, evaluation, and continuous improvement are integral parts of faculty teaching and performance evaluation.

N. Consistency with the State's Minority Student Achievement Goals (as outlined in COMAR 13B.02.03.05).

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

UMES mission is compatible with the State of Maryland's minority achievement goals. UMES is an 1890 land grant HBCU. Our programs attracts a diverse set of students with the majority of student population being African American and those who are multiethnic and multicultural. The University actively recruits minority populations for all undergraduate and graduate level degrees. Special attention is also provided to recruit females into the STEM and multidisciplinary programs at all degree levels – undergraduate, Master's, and doctoral. The same attention will be given to the proposed B.S. degree program in mechanical engineering.

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 program has no relationship to low productivity programs.

P. Adequacy of Distance Education Programs (as outlined in COMAR 13B.02.03.22)

1. **Provide affirmation and any appropriate evidence that the institution is eligible to provide Distance Education.**
2. **Provide assurance and any appropriate evidence that the institution complies with the C-RAC guidelines, particularly as it relates to the proposed program.**

Not applicable. The proposed program is not a distance education program.

Outlook

Re: [EXTERNAL] Provisional Articulation Agreements – Section H: Adequacy of Articulation (Confirmation)

From Lukens, Rhoda <rlukens@worwic.edu>
Date Fri 4/25/2025 8:16 AM
To Brown, Willie L <wlbrown@umes.edu>
Cc Thomas-Banks, Leesa P <lpthomasbanks@umes.edu>; Johnson, Etahe <ejohnson2@umes.edu>

Good morning,

We are happy to partner with you on these agreements and look forward to continuing work on these pathways for our students' success.

Thank you!

Rhoda Lukens, M.A.
Registrar
Wor-Wic Community College | rlukens@worwic.edu
Phone: 410-334-2908
Office: BH 109C
Pronouns: she/her

From: Brown, Willie L <wlbrown@umes.edu>
Sent: Thursday, April 24, 2025 2:52 PM
To: Lukens, Rhoda <rlukens@worwic.edu>
Cc: Thomas-Banks, Leesa P <lpthomasbanks@umes.edu>; Johnson, Etahe <ejohnson2@umes.edu>
Subject: [EXTERNAL] Provisional Articulation Agreements – Section H: Adequacy of Articulation (Confirmation)

Ms. Lukens,

In our efforts to advance the University of Maryland Eastern Shore's response to the anticipated proposal submissions, specifically Section H: Adequacy of Articulation, we are sending this message to formally include Wor-Wic Community College in confirming provisional agreement(s) for the program transfer pathways that have previously been shared.

This step aligns with MHEC's guidance to demonstrate institutional collaboration while we await final approval to fully execute the articulation agreements. The provisional agreements under discussion include the following transfer pathways:

- Associate in Science in STEM, Engineering Concentration to Bachelor of Science in Mathematics
- Associate of Science in STEM, Engineering Concentration to Bachelor of Science in Electrical Engineering
- Associate of Science in STEM, Engineering Concentration to Bachelor of Science in Mechanical Engineering
- Associate of Applied Science in Hospitality Management to Bachelor of Science in Private Club and Resort Management

Please let us know if you are in agreement with this provisional submission. We deeply value your partnership and look forward to continuing our collaborative work in alignment with MHEC's requirements.

V/r
Willie L. Brown, Jr., Ph.D.
Vice Provost for Faculty Affairs
University of Maryland Eastern Shore
Division of Academic Affairs
11868 Academic Oval
John T. Williams Hall Suite 3111
Princess Anne, MD 21853-1299
Tel: (410) 651-6038
Email: wlbrown@umes.edu

Cc:
Lessa Thomas-Banks, JD, Interim Vice Provost for Academic Affairs
Etahe Johnson, Ed.D, Articulation/Transfer Liaison

☐ **New Agreement** ☐ **Revised Agreement** ☒ **Provisional Agreement**
☐ **Effective Date:** ☐ **Next Review Date:**

ACADEMIC PROGRAM ARTICULATION AGREEMENT BETWEEN WOR-WIC COMMUNITY COLLEGE AND UNIVERSITY OF MARYLAND EASTERN SHORE REGARDING THE TRANSFER FROM ASSOCIATE OF SCIENCE IN STEM, ENGINEERING CONCENTRATION TO BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

This Academic Program Articulation Agreement ("Agreement") is entered into by and between Wor-Wic Community College (the "Sending Institution") and the University of Maryland Eastern Shore (the "Receiving Institution") (collectively, the "Institutions") to facilitate the transfer of academic credits from the STEM, Engineering Concentration, Associate degree, for the completion Mechanical Engineering, Bachelor's degree (the "Program(s)"):

Institution	Program ID/Title	Award Type	Statewide CIP
Wor-Wic Community College	490200 – STEM, Engineering Concentration	Associate's Degree	419999
University of Maryland Eastern Shore	091000 – Mechanical Engineering	Bachelor's Degree	141901

A. Qualifying Students

This Agreement pertains to the transfer of "Qualifying Students", *i.e.*, those students who:
1. Have completed the STEM, Engineering Concentration at Wor-Wic Community College in good standing and with a minimum CGPA of 2.0/4.0;
2. Are accepted for admission to the University of Maryland Eastern Shore; and
3. Are enrolled in Mechanical Engineering.

B. Responsibilities of the Institutions

The Institutions agree to implement the transfer of Qualifying Students in accordance with applicable law and the following requirements and protocols:

1. A Qualifying Student may transfer from Wor-Wic Community College to the University of Maryland Eastern Shore for the completion of the Bachelor of Science in Mechanical Engineering.

2. Courses that the University of Maryland Eastern Shore will accept credits for towards completion of the Bachelor of Science in Mechanical Engineering:

PROGRAM ARTICULATION TABLE

	Wor-Wic Community College	University of Maryland Eastern Shore
Program name	STEM, Engineering Concentration	Mechanical Engineering
Award Type (e.g., AAS)	AS	BS
Credit Length	60	120

SECTION A - General Education

Wor-Wic Community College			University of Maryland Eastern Shore			
Course Prefix & Number	Course Name	Credits	Course Prefix & Number	Course Name	Credits Applied	Credits NOT Applied
SDV 100	Fundamentals of College Study	1	ENGE 100	First Year Orientation with Engineering	1	
ENG 101	Fundamentals of English I	3	ENGL 101	Principles of Composition I	3	
MTH 201	Calculus I	4	MATH 112	Calculus I	4	
ENG 151	Fundamentals of English II	3	ENGL 102	Principles of Composition II	3	
SOC 101	Introduction to Sociology	3	SOCI 101	Introduction to Sociology	3	
CHM 105	General Chemistry I	4	CHEM 111/113	Principles of Chemistry I	3	1
COM 200	Interpersonal Communications	3	ENGL 203	Fundamentals of Contemporary Speech	3	
PYS 101	Introduction to Psychology	3	PYSC 100	Introduction to Psychology	3	
ART 101	Introduction to Art History	3	ARTS 101	Exploration of the Visual Arts	3	
PHY 141	Principles of Physics I	4	PHYS 161 /163	General Physics I: Mechanics and Particle Dynamics	4	
General Education Total		**30**	**Section A Subtotal**		**30**	

Special Notes, if any: **** UMES requires the completion of 7 credits in Biological and Physical Sciences and 6 credits in Social and Behavioral Sciences as part of its general education curriculum. ****

SECTION B – Program Core / Supportive Requirement

Course Prefix & Number	Course Name	Credits	Course Prefix & Number	Course Name	Credits Applied	Credits NOT Applied
EGR 101	Introduction to Engineering Design	3	ENGE 150	Modern Engineering Design	3	
MTH 202	Calculus II	4	MATH 211	Calculus II	4	
PHY 142	Principles of Physics II	4	PHYS 262 / 264	General Physics II w/ Lab	4	
EGR 202	Statics	3	ENGE 260	Statics	3	
MTH 205	Differential Equations	4	MATH 241	Differential Equations for Engineers	3	1
MTH 203	Calculus III	4	MATH 212	Calculus III	4	
PHY 243	Principles of Physics III	4	PHYS 263/265	General Physics III w/ Lab	4	
Program / Major Requirement Total		**26**	**Section A Subtotal**		**25**	
Total College Credits Applied (sum of sections A and B)					**55**	

Special Notes, if any: ****MATH 241 is a 3 credit at UMES. ****

SECTION C - Remaining University of University of Maryland Eastern Shore Requirements

UMES (General Education)		
Computer Literacy	BUAD 213, BUED 212, EDCI 306, ETGE 110, ETGE 111, ETGE 112	3
ENGL 305	Technical Writing	3
JEDI Course	(BUAD 311, DMST 440, ENGL 359, HUEC 230, or HUEC 463)	3
	Remaining General Education Subtotal	**9**
Mechanical Engineering Program Core		
ENGE 170	Programming Concepts for Engineers	3
ENGE 240	Basic Circuit Theory	3
ENGE 241	Analog Circuits Lab	1
ENGE 261	Dynamics	3
ENGE 270	Computer-Aided Design	3
ENGE 320	Statistics and Probability for Engineers	3
ENME 325	Properties of Materials	3
ENME 342	Fluid Mechanics	3
ENME 345	Thermodynamics	3
ENME 346	Heat Transfer	3
ENME 347	Thermal and Fluid Lab	1
ENGE 362	Mechanics of Materials	3
ENME 363	Properties and Mechanics of Materials Lab	1
ENGE 370	Computational Methods in Engineering	3
ENGE 380	Instrumentations	3
ENGE 382	Control Systems	3
ENGE 383	Control Lab	1
ENGE 475	Engineering Seminar I	1
ENGE 476	Senior Design Project I	2
ENGE 477	Senior Design Project II	2
	Mechanical Engineering Program Core Subtotal	**48**
Mechanical Engineering Major Electives		
ENAE 420	Aerodynamics	3
ENME 422	Mechanism and Machine Design	3
ENME 425	Rapid Prototype & Product Development	3
ENME 430	Finite Element Analysis	3
ENME 440	Mechatronics	3
ENME 442	Micro Electro-Mechanical Systems	3
ENME 365	Machine Element Design	3
ENME 462	Digital Control Systems	3
ENME 464	Embedded System Design Lab	2
ENAE 467	Design of Autonomous Aerial Systems	3
ENME 468	Robotics	3
ENME 469	Robotics and Automation Design Lab	2
ENME 470	Vibrations	3
ENME 472	Selected Topics in Engineering	3
	Remaining General Education Subtotal	**9**
	Remaining Program Core Subtotal	**48**
	Mechanical Engineering Major Elective Subtotal	**8**
	Total Remaining UMES Credits	**65**
	Total College Credits Applied (sum of sections A, B and C)	**120**

Special Notes, if any:

*Receiving Institution must indicate if the course is applied to General Education, Program/ Major requirements, or General Elective.

3. The Receiving Institution shall designate, and shall provide to the Sending Institution, the contact information for a staff person at the Receiving Institution who is responsible for the oversight of the transfer of Qualifying Students. The Sending Institution shall designate, and shall provide to the Receiving Institution, the contact information for a staff person at the Sending Institution who is responsible for the oversight of the transfer of Qualifying Students.

	Wor-Wic Community College	**University of Maryland Eastern Shore**
Name of staff person responsible for oversight	Ms. Rhoda Lukins	Dr. Etahe Johnson
Title of staff person	Registrar	Academic Support Associate / Articulation Liaison
Email address	rlukens@wor-wic.edu	ejohnson2@umes.edu
Telephone Number	410-334-2800	410-651-6038

Should the staff person or position change, the institution will promptly provide new contact information to the partner institution and inform the Maryland Higher Education Commission of the change.

Additional contact information:

Direct Points of Contact for Articulation Agreement	**Wor-Wic Community College**	**University of Maryland Eastern Shore**
Other staff person responsible for oversight	TBD	Dr. Willie L. Brown, Jr.
Title of staff person		Vice Provost for Faculty Affairs
Email address		wlbrown@umes.edu
Telephone Number		410-651-6038

4. If the Qualifying Student is using federal Title 38 VA Education Benefits (GI Bill® Education Benefits), the Institutions shall adhere to all applicable U.S. Department of Veterans Affairs' regulations, including the regulations governing the awarding prior credit, as regulated under Title 38, Code of Federal Regulations, Sections 21.4253(d)(3) and 21.4254(c)(4).

5. The transfer of Qualifying Students shall adhere to all applicable transfer requirements set forth in the Annotated Code of Maryland and the Code of Maryland Regulations.

6. Each Institution shall advise students regarding transfer opportunities under this Agreement, and shall advise students of financial aid opportunities and implications associated with the transfer.

7. Should either Institution makes changes to program requirements, the institution will inform the partner institution immediately. The articulation agreement should be updated to reflect the changes and forwarded to the Maryland Higher Education Commission.

C. Term and Termination

1. This Agreement shall become effective on the date it is signed by the appropriate and authorized representatives of each Institution.

2. The initial term of this Agreement shall be five (5) years from the effective date. Thereafter, the Agreement shall automatically renew for successive five (5)-year terms unless either Institution provides written notice of termination at least thirty (30) days prior to the expiration of the then-current term.

3. Either Institution may, at its sole discretion, terminate this Agreement by delivering thirty (30) days' written notice to the other Institution and the Maryland Higher Education Commission. If this Agreement is terminated prior to the end of the initial five (5)-year term, it shall automatically renew unless both Institutions mutually agree in writing to forego the renewal.

4. Both Institutions agree to meet once every two (2) years to review the terms of this Agreement and assess its effectiveness.

D. Amendment

1. This Agreement constitutes the entire understanding and agreement between the Institutions regarding their rights and obligations under the terms of the Agreement, superseding any prior or contemporaneous agreements or understandings.

2. This Agreement may be modified only by a written amendment executed by both Institutions.

E. Governing Law

This Agreement shall be governed by, and construed in accordance with, the laws of the State of Maryland.

F. Counterparts

This Agreement may be executed in counterparts, each of which shall be deemed to be an original, but all of which, taken together, shall constitute one and the same agreement.

G. Notice of Agreement

1. The Institutions agree to provide a copy of this Agreement, with any amendments, to the Maryland Higher Education Commission.

2. The Institutions agree to provide copies of this Agreement to all relevant individuals and departments of the Institutions, including but not limited to students, academic department chairs participating in the transfer, offices of the president, registrar's offices, and financial aid offices.

H. No Third-Party Beneficiaries

There are no third-party beneficiaries to this Agreement.

I. Representations and Warranties of the Parties

Both Institutions represent and warrant that the following shall be true and correct as of the Effective Date of this Agreement, and shall continue to be true and correct during the term of this Agreement:

1. The Institutions are and shall remain in compliance with all applicable federal, state, and local statutes, laws, ordinances, and regulations relating to this Agreement, as amended from time to time.

2. Each Institution has taken all action necessary for the approval and execution of this Agreement.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their duly authorized representatives.

Signatures:

University of Maryland Eastern Shore

By: RE Allen
Dr. Rondall Allen, Provost and Vice-President for Academic Affairs

04 / 28 / 2025
Date

UNIVERSITY OF MARYLAND
EASTERN SHORE

MEMORANDUM OF UNDERSTANDING
ACADEMIC PROGRAM ARTICULATION AGREEMENT BETWEEN
SOMERSET COUNTY PUBLIC SCHOOL
AND
UNIVERSITY OF MARYLAND EASTERN SHORE
REGARDING TRANSFER FROM
PROJECT LEAD THE WAY CREDITS
TO
BACHELOR OF SCIENCE IN ENGINEERING

This Academic Program Articulation Agreement ("Agreement") is entered into by and between Somerset County Public Schools (the "Sending Institution") and the University of Maryland Eastern Shore (the "Receiving Institution") (collectively, the "Institutions") to facilitate the transfer of academic credits from Project Lead the Way credits for the completion of ENGE 150 course credits of the Engineering Program (the "Program(s)"):

Institution	HEGIS Program Title	Award Type	Statewide CIP
Somerset County Public Schools	Project Lead the Way Engineering Program	Pre-college Credits	N/A
University of Maryland Eastern Shore	090100 General Engineering	Bachelor of Science Degree	140101

A. Qualifying Students

- This Agreement pertains to the transfer of "Qualifying Students", *i.e.*, those students who:
  1. Graduate from the Somerset County Public Schools
  2. Complete the entire Project Lead the Way Engineering program of study by taking all required courses;
  3. Earn a passing grade of 80% or above in all Project Lead the Way Engineering program of study;
  4. Take each end-of-course assessment for the Project Lead the Way Engineering program of study;
  5. Earn a high school diploma;
  6. Apply within five years of high school graduation to be accepted into UMES;
  7. Meet admission criteria for entrance into UMES as well as the admission dates and procedures that apply to all new students at UMES; and
  8. Upon acceptance into UMES, enroll as a full-time student for the subsequent semester and must complete that semester in order to receive credit for ENGE 150.
- ENGE 150 requires Math 109 College Algebra as the pre-requisite. An incoming student must be placed in Math 110 Trigonometry and Analytical Geometry or higher to have the Math 109 prerequisite waived. If an incoming student does not meet the prerequisite requirement on math, the student must take MATH 109 or equivalent at UMES or other institution with a grade "C" or above in order to receive credit for ENGE 150.

UNIVERSITY OF MARYLAND
EASTERN SHORE

B. Responsibilities of the Institutions

The Institutions agree to implement the transfer of Qualifying Students in accordance with applicable law and the following requirements and protocols:

1. Courses in the Project Lead the Way program that the University of Maryland Eastern Shore will accept credits for towards ENGE 150 Modern Engineering Design include:

Engineering Program (Specializations in Aerospace, Computer, Electrical, Mechanical) Pathway

Somerset County Public Schools Project Lead the Way Program of Study or Pathway Course Titles		**University of Maryland Eastern Shore Comparable Course in Engineering**			
Course Description	**Requirements**	**Course Number**	**Course Name**	**Credits**	**Applied to***
PLTW Engineering Program of Study • Introduction to Engineering Design; • Principles of Engineering • Engineering Design and Development; • Specialization Courses o Aerospace Engineering o Digital Electronics	Earn a Passing Grade of 80% or Higher in all Project Lead the Way Engineering Program of Study Pathway Courses; and Score at least at the Practiced Level on each of the PLTW end-of-course exams.	ENGE 150	Modern Engineering Design	3	Major Requirements

*Receiving Institution must indicate if course is applied to General Education, Program/Major requirements, or General Elective.

2. The Receiving Institution shall designate, and shall provide to the Sending Institution, the contact information for a staff person at the Receiving Institution who is responsible for the oversight of the transfer of Qualifying Students. The Sending Institution shall designate, and shall provide to the Receiving Institution, the contact information for a staff person at the Sending Institution who is responsible for the oversight of the transfer of Qualifying Students.

	Somerset County Public Schools	**University of Maryland Eastern Shore**
Name of staff person	Zachary D. Bartemy	Dr. Willie L. Brown, Jr.

responsible for oversight		
Title of staff person	PLTW Engineering Instructor	Interim Vice Provost for Institutional Planning & Quality
Email address	zbartemy@somerset.k12.md.us	wlbrown@umes.edu
Telephone Number	410-651-2285	410-651-6038

Should the staff person or position change, the institution will promptly provide new contact information to the partner institution of the change.

Additional contact information:

Direct Points of Contact for Articulation Agreement	**Somerset County Public Schools**	**University of Maryland Eastern Shore**
Name of person	Cortney Monar	Dr. Yuanwei Jin
Title of person	Director, Career and Technical Education	Professor and Chair Engineering and Aviation Sciences
Email address	cmonar@somerset.k12.md.us	yjin@umes.edu
Telephone Number	410-651-2285	(410) 651-6365

3. If the Qualifying Student is using federal Title 38 VA Education Benefits (GI Bill® Education Benefits), the Institutions shall adhere to all applicable U.S. Department of Veterans Affairs' regulations, including the regulations governing the awarding prior credit, as regulated under Title 38, Code of Federal Regulations, Sections 21.4253(d)(3) and 21.4254(c)(4).

4. Each Institution shall adhere to all applicable transfer requirements set forth in the Annotated Code of Maryland and the Code of Maryland Regulations.

5. Each Institution shall advise students regarding transfer opportunities under this Agreement, and shall advise students of financial aid opportunities and implications associated with the transfer.

6. Should either Institution make changes to program requirements, the institution will inform the partner institution immediately. The agreement should be updated to reflect the changes set forth in the College and Career Readiness and College Completion Act of 2013, Senate Bill (SB) 740. This legislation, passed in 2013 by the Maryland General Assembly, calls for students' eligibility in this agreement.

C. Term and Termination

1. This agreement shall be effective on the date that it is signed by the appropriate and authorized representatives of each Institution.

2. Either Institution may, at its sole discretion, terminate this Agreement upon delivering 30 days written notice to the other Institution.

3. Both Institutions agree to meet once every 5 year(s) to review the terms of this agreement.

D. Amendment

1. This Agreement constitutes the entire understanding and agreement of the Institutions with respect to their rights and obligations in carrying out the terms of the Agreement, and supersedes any prior or contemporaneous agreements or understandings.

2. This Agreement may be modified only by written amendment executed by both Institutions.

E. Governing Law

This Agreement shall be governed by, and construed in accordance with, the laws of the State of Maryland.

F. Counterparts

This Agreement may be executed in counterparts, each of which shall be deemed to be an original, but all of which, taken together, shall constitute one and the same agreement.

G. Notice of Agreement

1. The Institutions agree to provide copies of this Agreement to all relevant individuals and departments of the Institutions, including but not limited to students, academic department chairs participating in the transfer, offices of the president, registrar's offices, and financial aid offices.

H. No Third-Party Beneficiaries

There are no third-party beneficiaries to this Agreement.

I. Representations and Warranties of the Parties

UNIVERSITY OF MARYLAND
EASTERN SHORE

Both Institutions represent and warrant that the following shall be true and correct as of the Effective Date of this Agreement, and shall continue to be true and correct during the term of this Agreement:

1. The Institutions are and shall remain in compliance with all applicable federal, state, and local statutes, laws, ordinances, and regulations relating to this Agreement, as amended from time to time.

2. Each Institution has taken all action necessary for the approval and execution of this Agreement.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their duly authorized representatives.

University of Maryland Eastern Shore

By: Heidi M. Anderson
Dr. Heidi M. Anderson
President

10 / 20 / 2022
Date

By: R E Allen
Dr. Rondall E. Allen
Provost and VP for Academic Affairs

10 / 20 / 2022
Date

By: Derrek B. Dunn
Dr. Derrek B. Dunn
Dean, School of Business and Tech

10 / 20 / 2022
Date

MAT

Somerset County Public Schools

By: JBM
Dr. John B. Gaddis
Superintendent of Schools

10/17/22
Date

By: T A Davis 10/17/22
Mr. Thomas A. Davis
Deputy Superintendent

10/17/22
Date

By: Cortney U Monar
Mrs. Cortney Monar
Director of CTE

10/17/22
Date

HELLOSIGN

Audit Trail

TITLE	Somerset County Public School: Project Lead the Way Credits...
FILE NAME	Engineering Artic...rset_approved.pdf
DOCUMENT ID	be74878a8cc9f23bb678ea9b5f93830f614739e3
AUDIT TRAIL DATE FORMAT	MM / DD / YYYY
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SENT	**10 / 20 / 2022** 13:25:18 UTC	Sent for signature to Matthew Taylor (mataylor3@umes.edu), Dr. Derrek Dunn (ddunn@umes.edu), Dr. Rondall Allen (reallen@umes.edu) and Dr. Heidi M. Anderson (hmanderson@umes.edu) from wlbrown@umes.edu IP: 131.118.103.44
VIEWED	**10 / 20 / 2022** 13:26:01 UTC	Viewed by Matthew Taylor (mataylor3@umes.edu) IP: 131.118.103.55
SIGNED	**10 / 20 / 2022** 13:26:11 UTC	Signed by Matthew Taylor (mataylor3@umes.edu) IP: 131.118.103.55
VIEWED	**10 / 20 / 2022** 14:17:14 UTC	Viewed by Dr. Derrek Dunn (ddunn@umes.edu) IP: 174.192.198.64
SIGNED	**10 / 20 / 2022** 14:17:33 UTC	Signed by Dr. Derrek Dunn (ddunn@umes.edu) IP: 174.192.198.64

HELLOSIGN

Audit Trail

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DOCUMENT ID	be74878a8cc9f23bb678ea9b5f93830f614739e3
AUDIT TRAIL DATE FORMAT	MM / DD / YYYY
STATUS	● Signed

Document History

VIEWED	**10 / 21 / 2022** 01:17:32 UTC	Viewed by Dr. Rondall Allen (reallen@umes.edu) IP: 73.180.159.68
SIGNED	**10 / 21 / 2022** 01:18:49 UTC	Signed by Dr. Rondall Allen (reallen@umes.edu) IP: 73.180.159.68
VIEWED	**10 / 21 / 2022** 01:57:27 UTC	Viewed by Dr. Heidi M. Anderson (hmanderson@umes.edu) IP: 131.118.228.17
SIGNED	**10 / 21 / 2022** 01:58:01 UTC	Signed by Dr. Heidi M. Anderson (hmanderson@umes.edu) IP: 131.118.228.17
COMPLETED	**10 / 21 / 2022** 01:58:01 UTC	The document has been completed.