DATA ANALYTICS ENGINEERING, MS

Banner Code: EC-MS-DAEN

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The MS in Data Analytics Engineering is a multidisciplinary degree program in the College of Engineering and Computing, and is designed to provide students with an understanding of the technologies and methodologies necessary for data-driven decision-making. Students study topics such as data mining, information technology, statistical modeling, predictive analytics, optimization, risk analysis, and data visualization. It is aimed at students who wish to become data scientists and analysts in finance, marketing, operations, business/government intelligence and other information intensive groups generating and consuming large amounts of data.

Admissions & Policies

Admissions

Applicants must have completed a baccalaureate degree from a regionally accredited program with an earned GPA of 3.00 or better in their 60 highest-level credits. Applicants are expected to have completed a degree in engineering, business, computer science, statistics, mathematics, or information technology, with demonstrated foundational competence in calculus, statistics, and computer programming. Applicants without that formal academic preparation but with clear evidence of strong and extensive work experience in data or analytics, may also be considered on a case by case basis. DAEN 500 Data Analytics Fundamentals may be required for domestic students without a basic foundation in Data Analytics.

For each of the concentrations there are additional admission requirements. These are listed in the descriptions of the individual concentrations.

In addition to fulfilling Mason's admission requirements for graduate study, applicants must provide:

- Two letters of recommendation, preferably from academic references or references in industry or government who are familiar with the applicant's professional or academic accomplishments.
- Resume.
- Detailed statement of career goals and professional aspirations.
- Completed self-evaluation form.
- If the applicant's native language is not English, proof of English Proficiency Exam Score (https://www2.gmu.edu/admissions-aid/apply-now/how-apply/graduate/standardized-test-information/), if applicable.

Policies

Students are strongly encouraged to meet with their academic advisor during their first semester and design an approved plan of study. Students should seek out their advisor when questions arise and when their plan of study needs to be revised. Any changes to the plan of study are to be approved by the DAEN advisor.

Requirements

Degree Requirements

Total credits: 30

Core Courses

The following core coursework covers the basic elements of data analytics at the graduate level.

Code	Title	Credits
AIT 580	Analytics: Big Data to Information	3
CS 504	Principles of Data Management and Mining [1]	3
or CS 584	Theory and Applications of Data Mining	
DAEN 690	Data Analytics Project	3
OR 531	Analytics and Decision Analysis	3
or OR 541	Operations Research: Deterministic Models	
STAT 515	Applied Statistics and Visualization for Analytics [2]	3
or STAT 554	Applied Statistics I	
Total Credits		15

1. CS 504 (for all concentrations except Data Mining) or CS 584 (for the Data Mining concentration only)
2. STAT 515 (for all concentrations except Statistics for Analytics) or STAT 554 (for the Statistics for Analytics concentration only)

Concentrations

Students can elect a concentration that corresponds to a specialized technical area. Students not interested in a concentration can work with an advisor to select 15 credits of electives from among courses allowed in all the concentrations.

Available Concentrations

- Concentration in Applied Analytics (APAN)
- Concentration in Bioengineering (BIOE)
- Concentration in Business Analytics (BUSA)
- Concentration in Computational Linguistics (CMPL)
- Concentration in Cyber Analytics (CYBA)
- Concentration in Data Mining (DTM)
- Concentration in Financial Engineering (FNNE)
- Concentration in Health Data Analytics (HDAN)
- Concentration in the Internet of Things (INOT)
- Concentration in Mechanical Engineering (ME)
- Concentration in Naval Engineering (NAVL)
- Concentration in Predictive Analytics (PRAN)
- Concentration in Statistical Analytics (STLA)

Concentration in Applied Analytics (APAN)

Focuses on the practical elements of adapting big data approaches to common analytic problems and government operations.

Additional Admission Requirements
Students entering the program should have completed the following George Mason undergraduate courses or their equivalents:

Code	Title	Credits
IT 106	Introduction to IT Problem Solving Using Computer Programming	3
MATH 108	Introductory Calculus with Business Applications (Mason Core) (http://catalog.gmu.edu/mason-core/)	3
STAT 250	Introductory Statistics I (Mason Core) (http://catalog.gmu.edu/mason-core/)	3

Required Concentration Courses

Code	Title	Credits
AIT 524	Database Management Systems	3
Select four from the following:		12
AIT 526	Introduction to Natural Language Processing	
AIT 582	Metadata Analytics for Big Data	
AIT 590	Topics in Applied Information Technology	
AIT 614	Big Data Essentials	
AIT 622	Determining Needs for Complex Big Data Systems	
AIT 624	Knowledge Mining from Big-Data	
AIT 636	Interpretable Machine Learning	
AIT 664	Information: Representation, Processing and Visualization	
AIT 722	Theories and Models in Geo-Social Data Analytics	
AIT 724	Data Analytics in Social Media	
AIT 726	Natural Language Processing with Deep Learning	
AIT 736	Applied Machine Learning	
AIT 746	Applied Deep Learning	
DAEN 698	Data Analytics Research Project	
Total Credits		15

Concentration in Bioengineering (BIOE)

Focuses on data collection from medical devices/sensors and conditioning, filtering, extraction, and preparing the data.

Additional Admission Requirements
Students entering the program should have completed the following George Mason undergraduate courses or their equivalents:

Code	Title	Credits
BENG 320	Bioengineering Signals and Systems	3
MATH 113	Analytic Geometry and Calculus I (Mason Core) (http://catalog.gmu.edu/mason-core/)	4
MATH 114	Analytic Geometry and Calculus II	4
MATH 213	Analytic Geometry and Calculus III	3
MATH 214	Elementary Differential Equations	3
STAT 346	Probability for Engineers	3

Note:
Domestic students with some deficiencies in preparation may be admitted provisionally pending completion of foundation courses in mathematics or computer science. Undergraduate credit earned for this purpose may not be applied toward the graduate degree.

Required Concentration Courses

Code	Title	Credits
BENG 501	Bioengineering Research Methods	3
BENG 575	Intellectual Property, Regulatory Concepts and Product Development	3
ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	3
ECE 535	Digital Signal Processing	3
Select one from the following:		3
BENG 526	Neural Engineering	
BENG 538	Medical Imaging	
BENG 550	Advanced Biomechanics	
DAEN 698	Data Analytics Research Project	
ECE 537	Introduction to Digital Image Processing (DIP)	
Total Credits		15

Concentration in Business Analytics (BUSA)

Students will learn to effectively analyze data through the hands-on use of decision modeling and other techniques using popular software tools. This concentration utilizes a wide array of methodologies and techniques — from data collection, organization, reporting and mining to extraction of useful and actionable information for decision makers.

Additional Admission Requirements
Students entering the program must have successfully completed STAT 515 Applied Statistics and Visualization for Analytics or STAT 554 Applied Statistics I with a grade of B or better.

Required Concentration Courses

Code	Title	Credits
GBUS 738	Data Mining for Business Analytics	3
Select four from the following:		12
GBUS 720	Marketing Analytics	
GBUS 721	Marketing Research	
GBUS 739	Advanced Data Mining for Business Analytics	
GBUS 740	People Analytics	
GBUS 744	Fraud Examination	
Total Credits		15

Concentration in Computational Linguistics (CMPL)

This concentration focuses on applying big data approaches to natural language data problems. Students will be introduced to a wide range of natural language systems and phenomena and be prepared to design robust data analytic methods that scale to accommodate the diversity of language systems and questions of language use.

Required Concentration Courses

Code	Title	Credits
Linguistics Foundation Courses:		6
LING 687	Syntax I	
LING 689	Morphology	
Computational Linguistics Core:		6

LING 675	Computational Linguistics I	
LING 775	Computational Linguistics II	
Select one from the following:		3
LING 650	Introduction to Sociolinguistics	
LING 685	Typology	
DAEN 698	Data Analytics Research Project	
Total Credits		15

Concentration in Cyber Analytics (CYBA)

Deals with the process of acquiring, extracting, integrating, transforming, and modeling data with the goal of deriving useful information that is suitable for presentation in a court of law. Digital forensics is a key component in criminal, civil, intelligence, and counter-terrorism matters. Students will be able to apply data analytics to such areas as digital media, intercepted (network) data, mobile media, unknown code, and leverage that analysis in order to determine, intent, attribution, cause, effect, and context.

Additional Admission Requirements

Students entering the program should have completed the following George Mason undergraduate courses or their equivalents:

Code	Title	Credits
Computer Operating Systems		
CYSE 211	Operating Systems and Lab	3
Computer Networking		
IT 341	Data Communications and Network Principles	3
or TCOM 535	The TCP/IP Suite of Internet Protocols	
IT 445	Advanced Networking Principles	3
or TCOM 515	Internet Protocol Routing: Lecture and Laboratory Course	

Note:

Domestic students with some deficiencies in preparation may be admitted provisionally pending completion of foundation courses in mathematics or computer science. Undergraduate credit earned for this purpose may not be applied toward the graduate degree.

Required Concentration Courses

Code	Title	Credits
DFOR 510	Digital Forensics Analysis	3
DFOR 660	Network Forensics	3
Select three from the following:		9
DAEN 698	Data Analytics Research Project	
DFOR 661	Digital Media Forensics	
DFOR 663	Operations of Intrusion Detection for Forensics	
DFOR 664	Incident Response Forensics	
DFOR 698	Independent Reading and Research	
DFOR 761	Malware Reverse Engineering	
DFOR 767	Penetration Testing in Digital Forensics	
DFOR 768	Digital Warfare	
DFOR 780	Advanced Topics in Digital Forensics	
ECE 527	Learning From Data	
Total Credits		15

Concentration in Data Mining (DTM)

Aimed at students who are interested in understanding data mining, advanced database systems, MapReduce programming, pattern recognition, decision guidance systems, and Bayesian inference as they relate to data analytics.

Additional Admission Requirements

Students entering the program should have completed the following George Mason undergraduate courses or their equivalents:

Code	Title	Credits
CS 310	Data Structures	3
CS 330	Formal Methods and Models	3
CS 367	Computer Systems and Programming	4
CS 465	Computer Systems Architecture	3
MATH 125	Discrete Mathematics I (Mason Core) (http://catalog.gmu.edu/mason-core/)	3

Note:

Domestic students with some deficiencies in preparation may be admitted provisionally pending completion of foundation courses in mathematics or computer science. Undergraduate credit earned for this purpose may not be applied toward the graduate degree.

Required Concentration Courses

Code	Title	Credits
CS 657	Mining Massive Datasets with MapReduce	3
Select four from the following: [1]		12
CS 550	Database Systems	
CS 580	Introduction to Artificial Intelligence	
CS 650	Advanced Database Management	
CS 688	Machine Learning	
CS 775	Advanced Pattern Recognition	
CS 782	Advanced Machine Learning	
CS 787	Decision Guidance Systems	
DAEN 698	Data Analytics Research Project	
INFS 623	Web Search Engines and Recommender Systems	
INFS 740	Database Programming for the World Wide Web	
SYST 664	Bayesian Inference and Decision Theory	
Total Credits		15

[1] Note: all prerequisites must be met.

Concentration in Financial Engineering (FNNE)

The concentration emphasizes both analytical and practical aspects of financial and econometric data analytics. Students are expected to demonstrate proficiency in several quantitative modeling disciplines. Students are also expected to understand issues relevant to practical aspects of investment and hedging decision making, derivative valuation, and risk analysis. Students will learn the techniques to analyze large financial and economic data to derive meaningful knowledge, which will be useful for developing effective business and risk mitigation strategies and making sound financial, marketing, and investment decisions. The concentration prepares students for careers in business analytics with a

focus on practical applications in financial operations, investment, and risk mitigation strategy development.

Additional Admission Requirements
Students entering the program should have completed the following George Mason undergraduate courses or their equivalents:

Code	Title	Credits
CS 112	Introduction to Computer Programming (Mason Core) (http://catalog.gmu.edu/mason-core/)	4
MATH 113	Analytic Geometry and Calculus I (Mason Core) (http://catalog.gmu.edu/mason-core/)	4
STAT 344	Probability and Statistics for Engineers and Scientists I	3

Required Concentration Courses

Code	Title	Credits
SYST/OR 538	Analytics for Financial Engineering and Econometrics	3
SYST/OR 588	Financial Systems Engineering I: Introduction to Options, Futures, and Derivatives	3
SYST/OR 688	Financial Systems Engineering II: Derivative Products and Risk Management	3
Select two from the following:		6
DAEN 698	Data Analytics Research Project	
OR 541	Operations Research: Deterministic Models	
OR 542	Operations Research: Stochastic Models	
OR 604	Practical Optimization	
OR 645	Stochastic Processes	
SYST/OR 568	Applied Predictive Analytics	
SYST 573	Decision and Risk Analysis	
SYST 664	Bayesian Inference and Decision Theory	
Total Credits		15

Concentration in Health Data Analytics (HDAN)

This concentration focuses on analytics for health care. It provides coverage across several data analytics areas with specific application to the health care domain.

Code	Title	Credits
HAP 720	Health Data Integration	3
HAP 725	Statistical Process Control in Healthcare	3
HAP 780	Data Mining in Health Care	3
or HAP 880	Advanced Health Data Mining	
Select two from the following:		6
DAEN 698	Data Analytics Research Project	
HAP 671	Health Care Databases	
HAP 719	Advanced Statistics in Health Services Research I	
HAP 730	Health Care Decision Analysis	
or HAP 770	Medical Decision Making and Decision Support Systems	
HAP 819	Advanced Statistics in Health Services Research II	
HAP 823	Comparative Effectiveness Analysis using Observational Data	
Total Credits		15

Concentration in the Internet of Things (INOT)

The focus of this concentration is driven by sensors that collect the staggering amount of data that exists today. The Internet of Things (IoT) is expanding, at a geometric level, the number of devices that collect, forward, and offer for analysis data. IOTA looks at Data Analytics from the perspective of IoT and sensors. Analog and digital sensing design and deployment, hardware options, power consumption, security, sampling and quantization, Fourier transform, time analysis, and synchronization are topics covered in this concentration.

Additional Admission Requirements
Students entering the program should have completed the following George Mason undergraduate courses or their equivalents:

Code	Title	Credits
CS 222	Computer Programming for Engineers	3
ECE 301	Digital Electronics	3
ECE 321	Continuous-Time Signals and Systems	3
MATH 113	Analytic Geometry and Calculus I (Mason Core) (http://catalog.gmu.edu/mason-core/)	4
MATH 114	Analytic Geometry and Calculus II	4
STAT 346	Probability for Engineers	3

Required Concentration Courses

Code	Title	Credits
Select five courses from the following:		15
DAEN 698	Data Analytics Research Project	
ECE 508	Internet of Things	
ECE 527	Learning From Data	
ECE 530	Sensor Engineering	
ECE 535	Digital Signal Processing	
ECE 612	Real-Time Embedded Systems	
Total Credits		15

Concentration in Mechanical Engineering (ME)

This concentration will take advantage of mechanical engineering course offerings which will give students an opportunity to apply data analytics methods to real world engineering problems.

Required Concentration Courses

Code	Title	Credits
Select five courses from the following:		15
ME 620	Mechanical Engineering Decision Making	
ME 621	Foundations of Fluid Mechanics	
ME 714	Fracture Mechanics	
ME 721	Advanced Fluid Mechanics	
ME 742	Finite Element Analysis for Solids	
ME 745	Mechanics and Properties of Materials	
ME 750	Nanomaterials Enabled Renewable Energy	

ME 751	Advanced Materials for Water Treatment	
ME 753	Tribology and Surface Engineering	
ME 754	Introduction to Nano-Materials	
ME 755	Optofluidics	
ME 762	Nano Bio Sensors	
DAEN 698	Data Analytics Research Project	
Total Credits		15

Concentration in Naval Engineering (NAVL)

This concentration will take advantage of the naval engineering course offerings which will give students an opportunity to apply data analytics methods to real world engineering problems.

Required Concentration Courses

Code	Title	Credits
ME 551	Naval Engineering	3
ME 552	Fundamentals of Naval Architecture	3
ME 553	Ship Design Process and Tools	3
ME 554	Naval Project Management	3
DAEN 698	Data Analytics Research Project	3
Total Credits		15

Concentration in Predictive Analytics (PRAN)

The ultimate goal of analytics of Big Data is to derive value by suggesting effective actions for the future. Predictive analytics focuses on the methods for deciding on the best course of action, taking into account possible constraints and risks. The concentration will provide students with skills that drive effective decision making and optimization. Students will learn the techniques to analyze both structured and unstructured data to derive meaningful knowledge, which will be useful for developing effective strategies and making optimal decisions.

The concentration emphasizes both analytical and practical aspects of predictive analytics. Students are expected to master the practical aspects of modeling and methods for optimization. Students are also expected to demonstrate proficiency in decision making, design of decision support systems, and risk analysis. The program prepares students for careers in big data analytics with a focus on strategic decision making in practical applications including financial engineering, health care, transportation, and intelligence.

Additional Admission Requirements

Students entering the program should have completed the following George Mason undergraduate courses or their equivalents:

Code	Title	Credits
CS 112	Introduction to Computer Programming (Mason Core) (http://catalog.gmu.edu/mason-core/)	4
MATH 113	Analytic Geometry and Calculus I (Mason Core) (http://catalog.gmu.edu/mason-core/)	4
STAT 344	Probability and Statistics for Engineers and Scientists I	3

Required Concentration Courses

Code	Title	Credits
OR 604	Practical Optimization	3
SYST 542	Decision Support Systems Engineering	3
SYST 568	Applied Predictive Analytics	3
or OR 568	Applied Predictive Analytics	
SYST 573	Decision and Risk Analysis	3
Select one from the following:		3
DAEN 698	Data Analytics Research Project	
OR 541	Operations Research: Deterministic Models	
OR 542	Operations Research: Stochastic Models	
OR 603	Sports Analytics	
OR 610	Deep Learning for Predictive Analytics	
STAT 663	Statistical Graphics and Data Exploration I	
SYST 508	Complex Systems Engineering Management	
SYST 584	Heterogeneous Data Fusion	
SYST 618	Model-based Systems Engineering	
SYST 664	Bayesian Inference and Decision Theory	
SYST 670	Metaheuristics for Optimization	
or OR 670	Metaheuristics for Optimization	
Total Credits		15

Concentration in Statistical Analytics (STLA)

Provides students with skills necessary for gaining insight from data. Enables students to evaluate large data-sets from a rigorous statistical perspective, including theoretical, computational, and analytical techniques. Emphasis will be placed on developing deep analytical talent in the two areas of statistical modeling and data visualization. "Big Data" are well-known to encompass high levels of uncertainty and complex interactions and relationships. To gain knowledge from these data and hence inform decisions, elucidation of the core interactions and relationships must be done in a manner that acknowledges uncertainties in order to both minimize false signals and maximize true discoveries. Statistical modeling does exactly this – it accounts for uncertainty while identifying relationships. Visualization is often a critical component of modeling, but visualization also stands alone as an important tool for presentation of information, decision analysis, and process improvement.

Additional Admission Requirements

Students entering the program should have completed the following George Mason undergraduate courses or their equivalents:

Code	Title	Credits
MATH 203	Linear Algebra	3
MATH 213	Analytic Geometry and Calculus III	3
STAT 346	Probability for Engineers	3
or MATH 351	Probability	

Required Concentration Courses

Code	Title	Credits
STAT 544	Applied Probability	3
Select four from the following:		12
DAEN 698	Data Analytics Research Project	
STAT 654	Applied Statistics II	
STAT 662	Multivariate Analysis and Statistical Learning	
STAT 663	Statistical Graphics and Data Exploration I	

STAT 672	Statistical Learning and Data Analytics	
Total Credits		15

Accelerated Master's

Applied Computer Science, BS/Data Analytics Engineering, Accelerated MS

Overview

Highly-qualified students in the Applied Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/applied-computer-science-bs/) can complete both a BS-ACS and a Data Analytics Engineering, MS in five years through the BS-MS accelerated (BAM) program.

General BAM policies are in the catalog under AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7). Policies governing all graduate degrees are in the catalog under AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

Admission Requirements

Students in the Applied Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/applied-computer-science-bs/) program are encouraged to apply to the BAM program after earning 60 undergraduate credits with an overall GPA of at least 3.30. Students must also have successfully completed CS 310 Data Structures and CS 330 Formal Methods and Models.

Accelerated Option Requirements

Students accepted to the BAM program may earn up to 9 credits of graduate coursework that count towards both the BS and MS degrees. They may begin taking graduate courses after completing 75 undergraduate credits and successfully completing CS 367 Computer Systems and Programming.

The following graduate courses can replace the corresponding undergraduate courses. For all students in the Applied Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/applied-computer-science-bs/) program:

Code	Title	Credits
CS 584	Theory and Applications of Data Mining (to replace CS 484)	3

Students in the Software Engineering and Bioinformatics concentrations of the Applied Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering/computer-science/applied-computer-science-bs/) program may also register for:

Code	Title	Credits
CS 550	Database Systems (to replace CS 450)	3

Students in the Computer Game Design and Geography concentrations of the Applied Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/applied-computer-science-bs/) program may also register for one or both of the following courses:

Code	Title	Credits
CS 550	Database Systems (to replace CS 450)	3
CS 580	Introduction to Artificial Intelligence (to replace CS 480)	3

Notes:

- For students in the Computer Game Design and Geography concentrations of the Applied Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/applied-computer-science-bs/) program, one of the 500 level courses will count as an elective towards their undergraduate degree.
- Students may not use both the graduate course and the undergraduate alternative for their BS degree.
- Students must satisfy all recommended and required prerequisites for the graduate courses they take.
- Students must still take the DAEN core courses (AIT 580 Analytics Big Data to Information, OR 531 Analytics and Decision Analysis, and STAT 515 Applied Statistics and Visualization for Analytics).
- Students also have the option to take up to 6 additional credits of graduate coursework *on reserve*, which can be used for the MS degree only.

Degree Conferral

Students must apply for degree conferral the semester before they expect to complete their BS requirements. At the beginning of their final undergraduate semester, students must submit a completed Bachelor's-Accelerated Master's Transition form to the CS department office. The master's degree will be conferred after the student completes the MS requirements.

Applied Science, BAS (Data Analytics Concentration)/Data Analytics Engineering, Accelerated MS

Overview

Highly-qualified students in the Applied Science, BAS, Data Analytics Concentration (http://catalog.gmu.edu/colleges-schools/interdisciplinary-programs-courses/applied-science-bas/) have the option of obtaining an accelerated Data Analytics Engineering, MS. (http://catalog.gmu.edu/colleges-schools/engineering/data-analytics-engineering-ms/#text)

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7). For policies governing all graduate degrees, see AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

Admission Requirements

Students in the Applied Science, BAS Data Analytics concentration may apply to this option if they have earned 60 undergraduate credits with an overall GPA of at least 3.30. Students may begin taking the master's level courses once they have earned 75 undergraduate credits.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BAS and MS programs. The following six credits may overlap:

Code	Title	Credits
AIT 580	Analytics: Big Data to Information	3
CS 504	Principles of Data Management and Mining	3
or CS 584	Theory and Applications of Data Mining	
OR 531	Analytics and Decision Analysis	3
or OR 541	Operations Research: Deterministic Models	
STAT 515	Applied Statistics and Visualization for Analytics	3
or STAT 554	Applied Statistics I	

In addition to the six credits above, students may select up to 6 additional credits to overlap. These credits must be selected in consultation with both the BAS and DAEN advisors. Credits selected will depend on which DAEN concentration the student intends to pursue.

Bioengineering, BS/Data Analytics Engineering, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a BS in Bioengineering (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/bioengineering/bioengineering-bs/) and MS in Data Analytics Engineering with a concentration in Bioengineering in an accelerated time-frame.

See AP.6.7 Bachelor's/Accelerated Master's Degrees for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in the Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Students majoring in the Bioengineering, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/bioengineering/bioengineering-bs/) will be considered for admission into the BAM Pathway after completion of a minimum of 60 undergraduate credits with an overall GPA of at least 3.0. Students must have successfully completed CS 222 Computer Programming for Engineers and BENG 320 Bioengineering Signals and Systems. Criteria for admission are identical to criteria for admission to the Bioengineering concentration of the Data Analytics Engineering, MS program.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites

Accelerated Master's Admission Requirements

Students already admitted in the BAM Pathway will be admitted to the Data Analytics Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- A GPA of 3.0 or better in their 60 highest-level credits
- Successfully meeting Mason's requirements for undergraduate degree conferral (graduation) and completing the application for graduation.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students must complete all credits that satisfy requirements for both the BS and MS programs, with up to three classes (nine credits) overlap depending on their bioengineering concentration chosen from the following graduate courses:

Code	Title	Credits
AIT 580	Analytics: Big Data to Information	3
BENG 501	Bioengineering Research Methods	3
CS 504	Principles of Data Management and Mining (in place of BENG 420)	3
OR 531	Analytics and Decision Analysis	3
STAT 515	Applied Statistics and Visualization for Analytics	3
Total Credits		15

All graduate course prerequisites must be completed prior to enrollment. Each graduate course must be completed with a grade of B or better to apply toward the MS program. The graduate courses may be counted as Technical Electives or, in the case of CS 504 Principles of Data Management and Mining, for BENG 420 Biomedical Data Analytics towards the Bioengineering, BS program requirements with approval by the academic advisors of both the BS and MS programs.

While still in undergraduate status, a maximum of six additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree. These reserve credits can be chosen from the list of graduate level courses given above with approval by the academic advisors of both the BS and MS programs.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees policies.

Students are permitted to take additional graduate basic courses in their undergraduate programs. In such cases, those classes cannot be counted toward requirements for the MS.

Degree Conferral

Students are recommended to meet with the Bioengineering academic advisor one year before and must apply to the program one semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

Computer Science, BS/Data Analytics Engineering, Accelerated MS

Overview

Highly-qualified students in the Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/computer-science-bs/) can complete both

a BS-CS and a Data Analytics Engineering, MS in five years through the BS-MS accelerated (BAM) program.

General BAM policies are in the catalog under AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7). Policies governing all graduate degrees are in the catalog under AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

Admission Requirements

Students in the Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/computer-science-bs/) program are encouraged to apply to the BAM program after earning 60 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed CS 310 Data Structures and CS 330 Formal Methods and Models .

Accelerated Option Requirements

Students accepted to the BAM program may earn up to 9 credits of graduate coursework that count towards both the BS and MS degrees. They may begin taking graduate courses after completing 75 undergraduate credits and successfully completing CS 367 Computer Systems and Programming.

The following graduate courses can replace the corresponding undergraduate courses.

Code	Title	Credits
CS 584	Theory and Applications of Data Mining (to replace CS 484)	3
CS 550	Database Systems (to replace CS 450)	3
CS 580	Introduction to Artificial Intelligence (to replace CS 480)	3

Notes:

- Students may not use both the graduate course and the undergraduate alternative for their BS degree.
- Students must satisfy all recommended and required prerequisites for the graduate courses they take.
- Students must still take the DAEN core courses (AIT 580 Analytics Big Data to Information, OR 531 Analytics and Decision Analysis, and STAT 515 Applied Statistics and Visualization for Analytics).
- Students also have the option to take up to 6 additional credits of graduate coursework *on reserve*, which can be used for the MS degree only.

Degree Conferral

Students must apply for degree conferral the semester before they expect to complete their BS requirements. At the beginning of their final undergraduate semester, students must submit a completed Bachelor's-Accelerated Master's Transition form to the CS department office. The master's degree will be conferred after the student completes the MS requirements.

Mechanical Engineering, BS/Data Analytics Engineering, Accelerated MS

Overview

Highly-qualified students in the Mechanical Engineering, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/mechanical-engineering-bs/) program have the option of applying to the accelerated Data Analytics Engineering, MS program.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7). For policies governing all graduate degrees, see AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

Admission Requirements

Students in the Mechanical Engineering, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/mechanical-engineering-bs/) program may apply to the accelerated Data Analytics Engineering, MS program if they have earned 60 undergraduate credits with an overall GPA of at least 3.30.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with up to twelve credits overlap chosen from the following courses:

Code	Title	Credits
AIT 580	Analytics: Big Data to Information	3
CS 504	Principles of Data Management and Mining	3
OR 531	Analytics and Decision Analysis	3
STAT 515	Applied Statistics and Visualization for Analytics	3

All graduate course prerequisites must be completed prior to enrollment. Each 500-level course must be completed with a grade of B or better to apply toward the MS program. The graduate courses selected for overlap must be approved by the academic advisors of both the BS and MS programs. The graduate courses may be counted as Electives toward the Mechanical Engineering, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/mechanical/mechanical-engineering-bs/) program requirements, with approval of the Mechanical Engineering Department.

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.

Statistics, BS/Data Analytics Engineering, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program (BAM) and obtain the Statistics, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/statistics/statistics-bs/) and the Data Analytics Engineering, MS in an accelerated time-frame after satisfactory completion of a minimum of 138 credits.

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (http://catalog.gmu.edu/policies/academic/graduate-policies/).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.0.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific prerequisites.

Accelerated Master's Admission Requirements

Students already admitted in the BAM Pathway will be admitted to the Data Analytics Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- Completion of Mason's requirements for undergraduate degree conferral (graduation) and completion of application for graduation.
- An overall GPA of at least 3.0.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, students complete all credits that satisfy requirements for the BS and MS programs, with up to twelve credits overlap chosen from the following graduate courses:

Code	Title	Credits
CS 504	Principles of Data Management and Mining	3
or CS 584	Theory and Applications of Data Mining	
OR 541	Operations Research: Deterministic Models (Credit may not be received for both OR 441 and OR 541.)	3
or OR 531	Analytics and Decision Analysis	
STAT 515	Applied Statistics and Visualization for Analytics	3
or STAT 554	Applied Statistics I	
STAT 663	Statistical Graphics and Data Exploration I	3

All graduate course prerequisites must be completed prior to enrollment. Each graduate course must be completed with a grade of B or better to apply toward the MS program.

The graduate courses may be counted as Technical Electives toward the Statistics, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/statistics/statistics-bs/) program requirements, with approval of the Statistics Department undergraduate coordinator.

While still in undergraduate status, a maximum of six additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees (http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) policies.

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form (https://registrar.gmu.edu/forms/) that is submitted to the Office of the University Registrar and the VSE Graduate Admissions and Recruitment office. At the completion of MS requirements, a master's degree is conferred.

Systems Engineering, BS/Data Analytics Engineering, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Systems Engineering, BS and a Data Analytics Engineering, MS in an accelerated time-frame after satisfactory completion of a minimum of 141 credits.

Admitted students are able to use up to 12 graduate credits in partial satisfaction of requirements for the undergraduate degree. Upon completion and conferral of the bachelor's degree and with satisfactory performance (grade of 'B' or better) in each of the graduate courses, students are given advanced standing in the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#text) for policies related to this program.

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies and Bachelor's/Accelerated Master's Degree policies.

Systems Engineering, BS students will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits with an overall GPA of at least 3.0.

For the predictive analytics and financial engineering concentrations, students must submit evidence of:

- Satisfactory completion of courses in calculus, applied probability and statistics, and a scientific programming language.

- Familiarity with analytical modeling software, such as spreadsheets or math packages.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits and course-specific pre-requisites.

Accelerated Master's Admission Requirements

Students already admitted in the BAM Pathway will be admitted to the Data Analytics Engineering, MS program, if they have met the following criteria, as verified on the Bachelor's/Accelerated Master's Transition form:

- An overall GPA of at least 3.0
- Successfully meeting Mason's requirements for undergraduate degree conferral (graduation) and completing the application for graduation.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced Standing course: Students must complete all credits that satisfy requirements for both the BS and MS programs. Up to four courses (12 credits) of approved master's level courses taken as part of the undergraduate degree may be applied to the graduate degree.

These courses may be chosen from the list of graduate courses in the following table. For Systems Engineering, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-bs/) students, these graduate courses replace the corresponding undergraduate courses listed in the table. The undergraduate version of these courses may *not* be applied toward the Systems Engineering, MS.

Undergraduate	Graduate	
SYST 473	SYST 573	This course applies to only certain concentrations; Credit may not be received for both courses.
OR 441	OR 541	Satisfies OR 531 core requirement in the graduate program. Credit may not be received for both courses.
OR 442	OR 542	This course applies to only certain concentrations; Credit may not be received for both courses.
SYST 438	SYST 538	This course applies to only certain concentrations; Credit may not be received for both courses
SYST 468	SYST 568	This course applies to only certain concentrations; Credit may not be received for both courses
SYST 488	SYST 588	This course applies to only certain concentrations; Credit may not be received for both courses

For the predictive analytics and financial engineering concentration, any other 500-level course may be applied to both the undergraduate and graduate degrees with approval of the advisor and SEOR department chair.

OR 541 Operations Research: Deterministic Models will substitute for the OR 531 Analytics and Decision Analysis core requirement in the MS DAEN program. Students Bachelor of Science in Systems Engineering (http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-engineering-bs/) program are not permitted to take OR 531 Analytics and Decision Analysis.

Students must pay attention to the prerequisites required for a course, and the master's degree concentration that the course may satisfy.

While still in undergraduate status, a maximum of 6 additional graduate credits may be taken as reserve graduate credit and applied to the master's program. Reserve graduate credits do not apply to the undergraduate degree.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degrees (https://catalog.gmu.edu/policies/academic/graduate-policies/#text).

Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.