

TELECOMMUNICATIONS, MS

Banner Code: EC-MS-TCOM

Academic Advising

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The Master of Science in Telecommunications offers a blend of cutting-edge practice-oriented courses in network engineering, cloud computing, wireless communications (e. g. 5G), and cyber security. This industry-oriented program is designed for students who wish to enter the field of network engineering or are working in the field and want to advance their knowledge. The program concentrates on practical applications of network engineering, rather than on a theoretical approach, while providing a thorough education in the necessary engineering principles. Hands-on laboratory courses provide students with practical skills and knowledge needed to hit the ground running after graduation. This program also offers two certificate programs that may be incorporated into, and taken concurrently with, the MS in Telecommunications.

Admissions & Policies

Admissions

Requirements

Specific application deadlines and requirements (https://admissions.gmu.edu/grad/application-deadlines-and-requirements/?academicUnit=VS&_ga=1.107632321.273102085.1480697294) are available through the Office of Graduate Admissions.

The program is open to students who hold a BS or BA degree from an accredited college or university in engineering, math, science, computer science, business (with a quantitative background), economics, or other analytical disciplines, and students who have equivalent work experience indicating analytical aptitude. Depending on their background, some applicants may be required to complete 3 to 6 credits of preliminary coursework before they are allowed to enroll in any of the core courses or elective courses in the program. A minimum undergraduate GPA of 3.00 is usually required.

Students who begin in non-degree status may apply through the normal graduate admissions process (<https://www.gmu.edu/admissions-aid/apply-now/how-apply/graduate/>) to the degree-seeking TCOM program. Up to 12 credits earned in non-degree study may be transferred into the degree program. Please see AP.6.4.1 (<https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-4-1>) Non-degree Student Status for additional information.

Policies

GPA Requirements

A maximum of 6 credits of courses with grades of C or B- may be applied toward the degree. The student must present a GPA of at least 3.00 for all courses submitted for the degree.

Plan of Study

Before completing 9 credit hours of coursework, each student must submit to the TCOM office a plan of study that has been approved by the academic advisor. This plan should be kept up to date by regular consultation with the academic advisor. A final, signed version of the plan must be turned in when the student submits a graduation application.

Telecommunications Certificates

Two 15-credit Telecommunications certificates are offered by the department. Students may pursue these certificates as stand-alone programs through the normal admissions process or as a secondary certificate to their MS degree. Certificate courses are drawn directly from the MS in TCOM curriculum. If a student has successfully completed and conferred one of these certificates prior to acceptance to the MS, it is possible to transfer up to 12 credits (B or better) into the MS. Please note that no more than 12 credits of coursework can be brought in to the MS.

- Advanced Networking Protocols for Telecommunications Graduate Certificate (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/advanced-networking-protocols-telecommunications-graduate-certificate/>)
- Telecommunications Forensics and Security Graduate Certificate (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/telecommunications-forensics-security-graduate-certificate/>)

Requirements

Degree Requirements

Total credits: 30

Students must complete a minimum of 30 graduate credits beyond the bachelor's degree. The plan of study includes a 21-credit required core component and a 9-credit elective component. Electives should be chosen either from the list of elective courses or from one of the three concentration options.

Core Courses

Code	Title	Credits
TCOM 500	Modern Telecommunications	3
TCOM 514	Basic Switching: Lecture and Laboratory Course	3
TCOM 515	Internet Protocol Routing: Lecture and Laboratory Course	3
TCOM 535	The TCP/IP Suite of Internet Protocols	3
TCOM 570	Network Automation	3
TCOM 610	Border Gateway Protocol (BGP) Routing	3

TCOM 750	Coordinating Seminar	3
Total Credits		21

Electives

Code	Title	Credits
Select three courses from the following:		
TCOM 551	Digital Communication Systems	9
TCOM 552	Introduction to Mobile Communications Systems	
TCOM 607	Satellite Communications	
TCOM 608	Optical Communications Systems	
TCOM 611	Multi-Protocol Label Switching (MPLS) ¹	
TCOM 614	Advanced Routing Lab ¹	
TCOM 616	Cloud Network Technologies ¹	
TCOM 617	Enterprise Network Architecture ¹	
TCOM 631	Voice Over IP ¹	
TCOM 652	5G Service, Technology and Network	9
TCOM 660	Network Forensics ²	
TCOM 661	Digital Media Forensics ²	
TCOM 662	Advanced Secure Networking	
TCOM 663	Operations of Intrusion Detection for Forensics ²	
TCOM 664	Incident Response Forensics ²	
TCOM 590	Selected Topics in Telecommunications	
TCOM 690	Advanced Topics in Telecommunications	
ECE 532	Secure Wireless Communications and Networks	
ECE 542	Computer Network Architectures and Protocols	
ECE 552	Big Data Technologies	9
ECE 580	Small Spacecraft Engineering	
ECE 643	Network Switching and Routing	
ECE 646	Applied Cryptography	
ECE 660	Space Systems Engineering	
Total Credits		

¹ Applicable to the Concentration in Network Technologies

² Applicable to the Concentration in Network Forensics and Security

Concentration in Network Technologies (NTEC)

Code	Title	Credits
Select three courses from the following:		
TCOM 611	Multi-Protocol Label Switching (MPLS)	9
TCOM 614	Advanced Routing Lab	
TCOM 616	Cloud Network Technologies	
TCOM 617	Enterprise Network Architecture	
TCOM 631	Voice Over IP	
Total Credits		9

Concentration in Network Forensics and Security (NFSC)

Code	Title	Credits
Select three courses from the following:		
TCOM 660	Network Forensics	9
TCOM 661	Digital Media Forensics	
TCOM 663	Operations of Intrusion Detection for Forensics	
TCOM 664	Incident Response Forensics	
Total Credits		9

Concentration in Space Communication Systems (SCS)

Code	Title	Credits
Select three courses from the following:		
TCOM 551	Digital Communication Systems	9
TCOM 607	Satellite Communications	
ECE 580	Small Spacecraft Engineering	
ECE 660	Space Systems Engineering	
Total Credits		9

Accelerated Master's

Electrical Engineering, BS/ Telecommunications, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a BS in Electrical Engineering (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/electrical-computer/electrical-engineering-bs/>) and an MS in Telecommunications in an accelerated time-frame after satisfactory completion of a minimum of 142 credits.

See AP6.7 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 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 MS program, if they have met the following criteria, as verified on

the Bachelor's/Accelerated Master's Transition form: 3.0 overall GPA, 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 courses: Students may take up to 9 credits of graduate-level courses that will count as advanced standing (i.e., overlap between the BS/MS program) from the list below. At least one class (3 credits) needs to be an ECE course. These 9 credits of graduate-level courses may be selected to substitute in place of the 9 credits of technical electives required for the undergraduate degree:

Code	Title	Credits
TCOM 514	Basic Switching: Lecture and Laboratory Course	3
or TCOM 515	Internet Protocol Routing: Lecture and Laboratory Course	
TCOM 535	The TCP/IP Suite of Internet Protocols	3
ECE 542	Computer Network Architectures and Protocols	3
ECE 531	Introduction to Wireless Communications and Networks	3

Selected 600 level courses may be taken as well with permission of an advisor granted before registering for a given course.

Reserve credit courses: Additional courses (up to 6 credits) may be selected from the list below as credits to be put on reserve to be later applied to the graduate program. Students can take these courses while undergraduates but these reserve courses will only count for the graduate degree program.

Code	Title	Credits
TCOM 500	Modern Telecommunications	3
TCOM 514	Basic Switching: Lecture and Laboratory Course	3
TCOM 515	Internet Protocol Routing: Lecture and Laboratory Course	3
TCOM 535	The TCP/IP Suite of Internet Protocols	3
TCOM 552	Introduction to Mobile Communications Systems	3
TCOM 570	Network Automation	3
TCOM 590	Selected Topics in Telecommunications	1.5-3

Selected 600 level courses may be taken as well with permission of an advisor granted before registering for a given course.

For more detailed information on coursework and timeline requirements, see AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>).

Individualized Study, BIS/ Telecommunications, Accelerated MS Overview

Highly-qualified students in the Individualized Study, BIS (<http://catalog.gmu.edu/colleges-schools/humanities-social-sciences/>

[integrative-studies/individualized-study-bis/](http://catalog.gmu.edu/colleges-schools/engineering/electrical-computer/telecommunications-ms/)) have the option of obtaining an accelerated Telecommunications, MS (<http://catalog.gmu.edu/colleges-schools/engineering/electrical-computer/telecommunications-ms/>).

For more detailed information, see AP6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

Admission Requirements

Students in the Individualized Study, BIS (<http://catalog.gmu.edu/colleges-schools/humanities-social-sciences/integrative-studies/individualized-study-bis/>) program may apply for this option if they have earned 75 undergraduate credits (including 15 Mason resident credits) with an overall GPA of at least 3.00. Criteria for admission are identical to criteria for admission to the Telecommunications, MS (<http://catalog.gmu.edu/colleges-schools/engineering/electrical-computer/telecommunications-ms/>) program.

Accelerated Option Requirements

Students must complete all requirements for the BIS and MS programs, with 6 credits overlap.

Students select TCOM courses from the list below to meet the requirements of the accelerated program. Six credits of TCOM courses will be applied to meet the requirements of both the BIS and MS TCOM programs. An additional three credits of TCOM courses is required for the BIS Individualized Concentration (IND) with emphasis on telecommunication. Note that accelerated students can only take the courses in the list below if they passed the listed prerequisite course with a B or higher.

BIS Concentration

Total credits: 34-46

Students who are pursuing the Individualized Study, BIS (<http://catalog.gmu.edu/colleges-schools/humanities-social-sciences/integrative-studies/individualized-study-bis/>), Individualized concentration (IND) with an emphasis on telecommunications must take:

Code	Title	Credits
Select an additional 500-level TCOM course(s) from the list below		3
BIS 300	Understanding Interdisciplinary Studies	3
BIS 390	The Research Process	3
BIS 490	RS: Senior Project (Mason Core) (http://catalog.gmu.edu/mason-core/)	4
ECE 301	Digital Electronics	3
IT 341	Data Communications and Network Principles	3
TCOM 500	Modern Telecommunications	3
Select additional courses related to telecommunication ¹		9-21
Total Credits		31-43

¹ Required to reach the necessary number of credits for the BIS Individualized concentration.

Telecommunications Courses

Code	Title	Credits
TCOM 500	Modern Telecommunications	3
TCOM 535	The TCP/IP Suite of Internet Protocols	3
TCOM 608	Optical Communications Systems	3
TCOM 631	Voice Over IP	3

Note:

Accelerated students who have passed IT 341 Data Communications and Network Principles with a grade of B or higher will not be required to take TCOM 535 in the Telecommunications, MS core. Other TCOM courses may be approved on a case-by-case basis.

See each course for individual prerequisite requirements.

Degree Conferral

Students must apply the semester before they expect to complete the BIS requirements to have the BIS 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 that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

Information Technology, BS/ Telecommunications, Accelerated MS

Overview

Highly-qualified students in the Information Technology, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/information-technology-bs/>) have the option of obtaining an accelerated Telecommunications, MS.

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 Information Technology, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/information-technology-bs/>) program may apply for this option if they have earned 60 undergraduate credits and take graduate level courses after completion of 75 credits with an overall GPA of at least 3.00. Criteria for admission are identical to criteria for admission to the Telecommunications, MS program.

Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with a minimum of 3 credits (maximum 9 credits) overlapping from the following courses:

Code	Title	Credits
Select nine credits from the following:		9
TCOM 500	Modern Telecommunications (To satisfy the IT 300 BS, INFT requirement)	

TCOM 515	Internet Protocol Routing: Lecture and Laboratory Course (satisfies as one NTEL concentration course in the BS INFT program)	
TCOM 631	Voice Over IP (To satisfy the IT 484 BS, INFT requirement.)	
Total Credits		9

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.

Systems and Industrial Engineering, BS/ Telecommunications, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the bachelor's/accelerated master's program and obtain a Systems and Industrial Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-industrial-engineering-bs/>) and a Telecommunications, MS in an accelerated time-frame after satisfactory completion of a minimum of 141 credits.

Admitted students are able to use up to 12 credits of approved advanced standing graduate courses 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 advanced standing graduate courses, the courses are applied to partial satisfaction of requirements for the master's program.

See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://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 (<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 in the Systems and Industrial Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-industrial-engineering-bs/>) program who preferably have chosen to take the systems engineering of telecommunications elective sequence 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, and completed all MATH and PHYS requirements. Other students will be considered on their individual merit.

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

The criteria for admission are identical to criteria for admission to the Telecommunications, MS program. Students already admitted in the BAM Pathway will be admitted to the Telecommunications, 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 and Industrial Engineering, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/engineering/systems-operations-research/systems-industrial-engineering-bs/>) students, these graduate courses replace the corresponding undergraduate courses listed in the BS program. The undergraduate version of these courses, if any, may *not* be applied toward the Telecommunications, MS.

Code	Title	Credits
TCOM 500	Modern Telecommunications	3
TCOM 535	The TCP/IP Suite of Internet Protocols	3
OR 541	Operations Research: Deterministic Models	3
SYST 530	Systems Engineering Management I	3
SYST 573	Decision and Risk Analysis (if taken, replaces TCOM 521 in the telecommunications core requirements)	3

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 (<http://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.