TELECOMMUNICATIONS (TCOM)

500 Level Courses

TCOM 500: Modern Telecommunications. 3 credits.
Comprehensive overview of telecommunications, including current
status and future directions. Topics include review of evolution of
telecommunications; voice and data services; basics of signals and
noise, digital transmission, network architecture and protocols; local
area, metropolitan and wide area networks and narrow band ISDN;
asynchronous transfer mode and broadband ISDN; and satellite systems,
optical communications, cellular radio, personal communication systems,
and multimedia services. Examples of real-life networks illustrate
basic concepts and offer further insight. Offered by Electrical & Comp.
Engineering. May not be repeated for credit.

Recommended Prerequisite: TCOM 575, or equivalent.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy,
Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level
students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of
Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale.

TCOM 514: Basic Switching: Lecture and Laboratory Course. 3 credits.
Basic switching techniques and protocols for low and high-speed
digital packet networks (Ethernet, Frame Relay, ATM, X.25) are taught
within a half semester lecture series, followed by hands-on laboratory
for remainder of semester. Real-life scenarios taught in the laboratory
element through exercises that involve configuring switches and routers.
Offered by Electrical & Comp. Engineering. May not be repeated for credit.

Recommended Prerequisite: TCOM 530.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy,
Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level
students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of
Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Laboratory, Lecture

Grading:
This course is graded on the Graduate Regular scale.

TCOM 515: Internet Protocol Routing: Lecture and Laboratory Course. 3
credits.
Internet Protocol (IP) routing overview; static routing; dynamic routing;
default routing; access lists; route redistribution; RIP, OSPF, IGRP, EIGRP,
IS-IS, and BGP protocols submitted for comment. Real-life scenarios
taught in laboratory element through exercises that involve configuring
routers as network elements. Offered by Electrical & Comp. Engineering.
May not be repeated for credit.

Recommended Prerequisite: TCOM 535.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy,
Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level
students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of
Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Laboratory, Lecture

Grading:
This course is graded on the Graduate Regular scale.

TCOM 521: Systems Engineering for Telecommunications Management. 3
credits.
Advanced software principles, techniques, and processes for designing
and implementing complex telecommunication systems. Planning
and implementation of telecommunications systems from strategic
planning through requirements, initial analysis, general feasibility study,
structured analysis, detailed analysis, logical design, and implementation.
Current system documentation through use of classical and structured
tools and techniques for describing flows, data flows, data structures,
file designs, input and output designs, and program specifications.
Practical experience gained through project. Offered by Electrical &
Comp. Engineering. May not be repeated for credit.

Recommended Prerequisite: TCOM 500.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy,
Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level
students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of
Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale.

TCOM 530: Data Communications Fundamentals. 3 credits.
Covers the foundations of modern data communications. The lower
layers of the OSI reference model are discussed with an emphasis on
the data link and the network layers. Concepts are illustrated by drawing
examples from important data networks ranging from local area networks
telecommunications. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 535:** The TCP/IP Suite of Internet Protocols. 3 credits.

**Recommended Prerequisite:** TCOM 530.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 530:** Project Management in Telecommunications. 3 credits.
Develops integrated approach to managing major telecommunications project; evaluates and uses tools and software for project management, with specific goals of containing costs and time overruns; introduces elements for resolving conflict resolution and applying motivation within project team, and gaining the ability to monitor and control projects in changing environment; develops understanding of unique attributes of major telecommunications systems such as interoperability requirements and international technical standards. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 547:** Introduction to Mobile Communications Systems. 3 credits.
Introduces mobile communication system design and analysis. Topics include mobile communication channel, access and mobility control, mobile network architectures, connection to fixed network, and signaling protocols for mobile communication systems. Offers examples of mobile communication systems including panEuropean GSM system, North American DAMPS system, and Personal Communication Systems. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 500, TCOM 551.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.
**TCOM 555: Network Management Foundations and Applications.** 3 credits.
Definitions and explains techniques that network managers utilize to maintain and improve performance of telecommunications network; network management system; five tasks traditionally involved with network management (fault management, configuration management, performance management, security management, and accounting management); theoretical background in transmission systems sufficient to understand network parameters such as capacity and response times; and specific network management products. Also explores how network performance data should be used for management and when considering upgrades in network architecture. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 500 and TCOM 530.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 561: Security, Privacy, and Applied Cryptography for Telecommunications.** 3 credits.
Provides quantitative foundations in mathematical and electrical concepts to permit registration for courses in telecommunications MS degree and certificate programs. Topics include polynomials, exponentials and logarithms, basic probability and statistics, trigonometric functions, Ohm's law, Kirchhoff's law, decibel notation. Notes: Course cannot be used for credit in any IT&E graduate degree program. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 500 and TCOM 530.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 575: Quantitative Foundations for Telecommunications.** 3 credits.
Defines and explains techniques that network managers utilize to secure cyberspace, and cybersecurity organizations; organizational structure for network defense; best practices, security policy, and threats; actors and tools, countermeasures, vulnerability identification/correction, intrusion detection, and impact assessment; firewalls and intrusion detection systems; antivirus software; active defense; disaster recovery, and law enforcement and privacy issues. Reviews threats and vulnerabilities in network systems based on reports, case studies available in the literature, and actual experience. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 500.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 590: Selected Topics in Telecommunications.** 1.5-3 credits.
Selected topics from recent developments and applications in various engineering disciplines within specialty modules 1, 2, and 3 of the TCOM program. The course is designed to help the professional engineering community keep abreast of current developments. Notes: The 1.5-credit course lasts for one-half semester (approximately seven weeks) while the...
3-credit course lasts for the full semester. Offered by Electrical & Comp. Engineering. May be repeated within the term for a maximum 9 credits.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Special scale.

**Additional Course Details:** Title varies by section and/or semester

**TCOM 598: Independent Study in Telecommunications.** 1.5-3 credits.
Directed self-study of special topics in telecommunications that relate to specialty modules 1, 2, and 3. Topics must be arranged with instructor and approved by program director before registering. Notes: May be taken for either 1.5 credits or 3.0 credits in fall and spring semesters. No more than total 6 credits may be taken from combination of TCOM 598, 599, 696, and 697 courses for credit in TCOM program. Offered by Electrical & Comp. Engineering. May be repeated within the degree for a maximum 6 credits.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Independent Study

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 551.**

**TCOM 552.**

**TCOM 606: Advanced Mobile Communications Systems.** 3 credits.
Introduction to post-second generation cellular systems; benefits and features of third-generation (3G) systems and personal communications services (PCS); review of air interface standards and transmission technologies for mobile and quasi-stationary wireless systems, including cellular networks, satellite networks, indoor systems (Wi-Fi, Personal Local Area Networks, Orthogonal Frequency Multiplexing, Ultra Wide Band technologies); review of network control strategies; investigation of user authentication, privacy, and data and voice encryption aspects. Evolving technology, analysis of competing multiple access methods, transition plans, and backward compatibility between 2G, 2.1/2 G, 3G, and future systems, with possible fallback plans. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 552.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 607: Satellite Communications.** 3 credits.
Topics include introduction to satellite communications systems; historical aspects; orbital mechanics and launchers; satellite components such as payload, orbital maneuvering systems, cooling systems, and antennas; look angle predictions; link budget; overall link design; multiple access such as TDMA, CDMA, ALOHA, TDMA, and MFTDMA; error control for digital satellite links; propagation effects on satellite links; elements of VSAT systems and nongeostationary satellite systems; and direct broadcast satellite services. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 551.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 608: Optical Communications Systems.** 3 credits.
Introduction and Overview of Optical Fiber Communications Systems and Optical Communication Networks. Specific topics include Optical Resonators; Photons and Matter, Lasers, Photons in Semiconductors; Semiconductor Photon Sources and Detectors; Light Emitting Diodes; Modulation of Optical Signals; Optoelectronic Networks; FDDI, Fiber channel, SONET, SDH, Ethernet on Optical Networks; Wavelength Division Multiplexing (WDM) networks; Basics of Fiber Optic System Design. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 500.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.
Students in a Non-Degree Undergraduate degree may not enroll. Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 609: Interior Gateway Protocol (IGP) Routing.** 3 credits.
Discusses development of Interior Gateway Protocols, including standards documents; interaction between various interior and exterior gateway protocols; design procedures and implementation aspects; field trial issues; and analysis of latest RFC information posted on IETF web site. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 515 and TCOM 535, or equivalent.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 610: Border Gateway Protocol (BGP) Routing.** 3 credits.
Discusses development of Border Gateway Protocol and its application in today's Internet routing architecture. Covers evolution of Internet, BGP routing standard specifications (RFCs), interaction between various routing protocols, network BGP routing design principals and procedures for enterprise and ISP networks, BGP's real-world implementation and configuration syntax, network scalability and convergence issues, and the latest extension and proposals for new standards. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 509 and TCOM 515, or equivalent.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 611: Multi-Protocol Label Switching (MPLS).** 3 credits.
Develops full understanding of Multi-Protocol Label Switching (MPLS) theory, technology, and implementation aspects through detailed analysis of MPLS routing concepts and protocol stacks, and completion of major project to reinforce understanding of MPLS. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 609 or 610

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 631: Voice Over IP.** 3 credits.
Presents the protocols used for transporting voice over Packet Switched Network. Topics include: Signaling basics; Topics; VoIP Network Scenarios and Connection Strategies; Communication Protocols: RTP, RTCP; VoIIP Decomposition; Performance and quality metrics for VoIP; VoIP Signaling Protocols: H.323, SIP, SS7; Softswitches: architecture, functionality, application; VoIP-PSTN integration and migration; VoIP Quality and QoS; VoIP Security: Vulnerabilities, remedies; NextGen VoIP; VoIP Mobility, Equipment, Voice XML, IMS; Future of VoIP. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 535.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 653: Global Positioning System (GPS).** 3 credits.
Presents in-depth treatment of theoretical and practical aspects of the Global Positioning system. Topics include: Basic Transmission Engineering for GPS; Spaced-Based Systems, Navigation, GPS Architecture, Signals, Ranging; Sources of Ranging Errors, Atomic Clocks, Timescales, Frequency Stability, Time Distribution, Carrier-to-Noise Ratio (C/No), Noise Figure and Noise Factor, Code and Signal Generation. Signal Acquisition and Tracking, Modulation/Demodulation, Correlation, Time-To-First-Fix, Almanac and Dual-Frequency Capability; Differential
Recommended Prerequisite: TCOM 500.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale.

TCOM 660: Network Forensics. 3 credits.
Deals with collection, preservation, and analysis of network-generated digital evidence so it can be successfully presented in civil or criminal court of law. Examines relevant federal laws and private sector applications. Examines capture/intercept of digital evidence, analysis of audit trails, recordation of running processes, and reporting of such information. Offered by Electrical & Comp. Engineering. May not be repeated for credit. Equivalent to CFRS 660.

Recommended Prerequisite: TCOM 535, and working knowledge of computer programming.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale.

TCOM 661: Digital Media Forensics. 3 credits.
Deals with collection, preservation, and analysis of digital media so this evidence can be successfully presented in civil or criminal court of law. Examines relevant federal laws and private sector applications. Examines seizure, preservation, and analysis of digital media. Offered by Electrical & Comp. Engineering. May not be repeated for credit. Equivalent to CFRS 661.

Recommended Prerequisite: TCOM 548 and 556, or TCOM 562, and working knowledge of computer operating systems; or permission of instructor.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale.

TCOM 662: Advanced Secure Networking. 3 credits.
Advanced technologies in network security that can be applied to enhance enterprise and ISP’s network security. Covers network perimeter defense concept and various components for complete layered defense system. Examines each component and its technologies, including TCP/IP protocol vulnerabilities, router access control list (ACL), dynamic ACL, firewall, network address translation (NAT), virtual private network (VPN), IPSec tunnels, intrusion detection system (IDS), routing protocol security, denial-of-service (DOS) attack, DOS detection and mitigation techniques. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

Recommended Prerequisite: TCOM 535 and TCOM 562, and a working knowledge of network routing protocols.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

Schedule Type: Lecture

Grading:
This course is graded on the Graduate Regular scale.

TCOM 663: Advanced Intrusion Detection for Forensics. 3 credits.
Introduces students to network and computer intrusion detection and its relation to forensics. It addresses intrusion detection architecture, system types, packet analysis, and products. It also presents advanced intrusion detection topics such as intrusion prevention and active response, decoy systems, alert correlation, data mining, and proactive forensics. Offered by Electrical & Comp. Engineering. May not be repeated for credit. Equivalent to CFRS 663.

Recommended Prerequisite: TCOM 535 and a working knowledge of computer programming.

Registration Restrictions:
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may not enroll.
Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 664: Incident Response Forensics.** 3 credits.
This course addresses incident detection, response, and those aspects of computer forensics pertinent to the investigation of trade secret theft, economic espionage, copyright infringement, piracy, and fraud. Procedures for gathering, preserving, and analyzing forensic evidence are discussed in detail and are applied to both computer and network incident response forensics. Offered by Electrical & Comp. Engineering. May not be repeated for credit. Equivalent to CFRS 664.

**Recommended Prerequisite:** TCOM 535.

**Registration Restrictions:**
Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Independent Study

**Grading:**
This course is graded on the Graduate Special scale.

**TCOM 696:** Independent Studies. 1.5-3 credits.
For students who wish to pursue studies in specific areas of advanced topic. Topics include: Industrial Telecommunications; Advanced Link Design; Detection and Estimation Theory; and other topics to be determined by student and instructor. Offered by Electrical & Comp. Engineering. May be repeated for credit with permission of the instructor. No more than 6 credits may be earned in this course.

**Additional Course Details:** Title varies by section and/or semester

**TCOM 698:** Independent Study. 1.5-3 credits.
For students who wish to pursue studies in specific areas of advanced topic. Topics include: Industrial Telecommunications; Advanced Link Design; Detection and Estimation Theory; and other topics to be determined by student and instructor. Offered by Electrical & Comp. Engineering. May be repeated for credit with permission of the instructor. No more than 6 credits may be earned in this course.

**TCOM 699:** Independent Study. 1.5-3 credits.
For students who wish to pursue studies in specific areas of advanced topic. Topics include: Industrial Telecommunications; Advanced Link Design; Detection and Estimation Theory; and other topics to be determined by student and instructor. Offered by Electrical & Comp. Engineering. May be repeated for credit with permission of the instructor. No more than 6 credits may be earned in this course.

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**TCOM 698:** Independent Studies. 1.5-3 credits.
For students who wish to pursue studies in specific areas of advanced topic. Topics include: Industrial Telecommunications; Advanced Link Design; Detection and Estimation Theory; and other topics to be determined by student and instructor. Offered by Electrical & Comp. Engineering. May be repeated for credit with permission of the instructor. No more than 6 credits may be earned in this course.

**TCOM 699:** Independent Study. 1.5-3 credits.
For students who wish to pursue studies in specific areas of advanced topic. Topics include: Industrial Telecommunications; Advanced Link Design; Detection and Estimation Theory; and other topics to be determined by student and instructor. Offered by Electrical & Comp. Engineering. May be repeated for credit with permission of the instructor. No more than 6 credits may be earned in this course.

**TCOM 707:** Advanced Link Design. 3 credits.
Topics include advanced satellite link design such as VSAT optimization, intersatellite systems, and propagation mitigation trade-offs; radar link design such as primary and secondary radars, range ambiguities, false alarms, Doppler radar, FM radar, radar tracking, radar transmitters
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and receivers, and phased array radars; terrestrial wireless link design including line of sight, LMDS, and nonline of sight; optical link design including laser options, diffraction limits, lidar and communications links, tracking limitations, and GEO and LEO intersatellite link design; Wi-Fi link design; and directed energy systems. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** TCOM 551, TCOM 607, or permission of instructor.

**Registration Restrictions:**
Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Lecture

**Grading:**
This course is graded on the Graduate Regular scale.

**TCOM 750:** Coordinating Seminar. 3 credits.
Open only to students in MA or MS in telecommunications programs with at least 18 credits of course work prior to registration. Topics include specific telecommunications problems in management, law, engineering, education, and communications. Focuses on ways a problem in one area can create or solve a problem in other areas. Offered by Electrical & Comp. Engineering. May not be repeated for credit.

**Recommended Prerequisite:** Open only to students in the MA or MS in telecommunications programs with at least 18 credit hours of course work prior to registration.

**Registration Restrictions:**
Enrollment is limited to students with a major in Telecommunications or Telecommunications.

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Enrollment limited to students in the College of Science, Schar School of Policy and Gov or Volgenau School of Engineering colleges.

**Schedule Type:** Seminar

**Grading:**
This course is graded on the Graduate Regular scale.