TELECOMMUNICATIONS (TDC)

TDC 261 | BASIC COMMUNICATION SYSTEMS | 4 quarter hours
(Undergraduate)
(Formerly TDC 361) Introduction to voice, data, and multi-media network communications fundamentals. Wired, Wireless, and Optical applications in Local, Metropolitan, Wide Area Networks are explored. The overview explains how technical, regulatory, competitive, standardization and cultural factors impact modern network applications. Approved for Scientific Inquiry credit. PREREQUISITE(S): NONE.

TDC 311 | COMPUTERS IN TELECOMMUNICATIONS SYSTEMS | 4 quarter hours
(Undergraduate)
This course is an introduction to computer architecture and operating systems with an emphasis on network systems. Topics covered include computer components and functions, logic circuits, process management, memory management, file management, interrupts and I/O peripheral devices, as well as computer networks, distributed systems, and network administration. Students will have several hands-on labs utilizing a Linux environment and will use Shell script for basic systems and network administration as well. PREREQUISITE(S): None.

TDC 362 | PRINCIPLES OF DATA COMMUNICATIONS | 4 quarter hours
(Undergraduate)
Theory and components of data communication systems, modes, codes, and error detection techniques for data transmission, network protocols and line control procedures, communication carrier facilities and system planning. PREREQUISITE(S): (TDC 311 or CSC 373) and (IT 263 or TDC 261)
(TDC 311 or CSC 373) and (IT 263 or TDC 261) are prerequisites for this class.

TDC 363 | INTRODUCTION TO LOCAL AREA NETWORKS | 4 quarter hours
(Undergraduate)
This course covers the principles of local area network (LAN) technologies including protocols, hardware, LAN software and design concepts. The course will focus on the lower layers of the OSI model and explore Ethernet, bridging/switching, VLANs, securing the network and Spanning-tree and Rapid-Spanning-tree protocols. Basic inter-VLAN routing will also be investigated. The course will involve several extensive lab exercises and troubleshooting activities to help reinforce the concepts. PREREQUISITE(S): TDC 261 or IT 263.
TDC 261 or IT 263 is the prerequisite for this class.

TDC 364 | VOICE COMMUNICATIONS TECHNOLOGIES | 4 quarter hours
(Undergraduate)
A detailed study of transmission, signaling and switching systems for facilities-based public and private voice networks. Voice digitization and transmission over circuit-switched and packet-switched infrastructures. Computer telephony integration techniques. Quality of service issues in integrated voice-over-data systems. Course may include laboratory work with PBX lab. PREREQUISITE(S): IT 263.
IT 263 is a prerequisite for this class.

TDC 365 | NETWORK INTERCONNECTION TECHNOLOGIES | 4 quarter hours
(Undergraduate)
A comprehensive study of network interconnection technologies including layer 2 bridges and switches, layer 3 routers and higher-layer gateways. The TCP and IP protocols will be studied in detail, including IP address management and router operations and management along with associated Internet protocols. RIP and OSPF protocols will be considered. Course includes laboratory work with protocol analyzers and router administration. PREREQUISITE(S): TDC 363.
TDC 363 is a prerequisite for this class.

TDC 366 | NETWORK PROGRAMMING | 4 quarter hours
(Undergraduate)
Programming distributed client/server applications; the sockets interface and multitasking issues; client/server models; remote procedure call; examples of applications such as electronic mail and file transfer. PREREQUISITE(S): CSC 309.
CSC 309 is a prerequisite for this class.

TDC 368 | NETWORK PERFORMANCE ANALYSIS AND DESIGN | 4 quarter hours
(Undergraduate)
Quantitative foundations of network performance analysis. Probability theory and queueing theory will be developed and applied to problems in LAN performance, traffic engineering, and the analysis of throughput and response time measures for data communications networks. Performance tradeoffs in network design. PREREQUISITE(S): IT 223 and MAT 151 and TDC 365.

TDC 369 | NETWORK PERFORMANCE ANALYSIS AND DESIGN | 4 quarter hours
(Undergraduate)
A survey of access line technologies used to access Internet and other business network services. Topics will include traditional DS1, DS3 and SONET transport as well as Integrated Services Digital Network (ISDN), Digital Subscriber Line (DSL), Cable Modems, satellite services, Asynchronous Transfer Mode (ATM), and wireless data access methods. PREREQUISITE(S): TDC 365 or IT 261.
TDC 261 or IT 263 is the prerequisite for this class.

TDC 371 | WIRELESS COMMUNICATIONS NETWORKS | 4 quarter hours
(Undergraduate)
A survey of modern wireless technologies with an emphasis on cellular and personal connection technologies. Topics include wireless system operations, management, signaling, security, planning and maintenance. Realization of real-time and non-real-time traffic, VoIP, Voice over LTE (VoLTE), and Quality-of-Service (QoS). Some assignments may use the 5G De-Mobile Lab facilities. PREREQUISITE(S): IT 263 or TDC 261.
TDC 261 or IT 263 is the prerequisite for this class.

TDC 372 | DIGITAL ACCESS SERVICES | 4 quarter hours
(Undergraduate)
A survey of access line technologies used to access Internet and other business network services. Topics will include traditional DS1, DS3 and SONET transport as well as Integrated Services Digital Network (ISDN), Digital Subscriber Line (DSL), Cable Modems, satellite services, Asynchronous Transfer Mode (ATM), and wireless data access methods. PREREQUISITE(S): TDC 362.
TDC 362 is a prerequisite for this class.

TDC 373 | NETWORK PROTOCOLS | 4 quarter hours
(Undergraduate)
TDC 365 is a prerequisite for this class.

TDC 375 | NETWORK PROJECT | 4 quarter hours
(Undergraduate)
Case study in developing a large network project. Students will work in groups to analyze and design a major network system. PREREQUISITE(S): TDC 365.
TDC 365 is a prerequisite for this class.
TDC 377 | FUNDAMENTALS OF NETWORK SECURITY | 4 quarter hours  
(Undergraduate)  
Fundamentals of Network security design and implementation. Review of components used in an enterprise security infrastructure including routers, firewalls, security auditing and assessment tools, Virtual Private Networks (VPN) and Intrusion Detection Systems (IDS). The integration of the different components will be studied in detail, including IP addressing, Network Address Translation (NAT), design of firewall rule sets and performance considerations. Course includes laboratory work with routers, firewalls, Virtual Private Networks and security assessment tools. Pre-req: TDC 365. 
TDC 365 is a prerequisite for this class.

TDC 378 | INFORMATION STORAGE AND MANAGEMENT | 4 quarter hours  
(Undergraduate)  
This course provides a comprehensive overview of network-based storage technology and information storage infrastructure. Major topics include the storage architectures, service features, and benefits of Intelligent Storage Systems. Networked storage technologies include fiber channel (FC), based Storage Area Network (SAN), Network Attached Storage (NAS), and IP-SAN. Advanced storage technologies on Content Addressed Storage (CAS), information security, and storage virtualization are also discussed. PREREQUISITE(S): none.

TDC 379 | TELECOMMUNICATION AND NETWORK SECURITY PRACTICUM | 4 quarter hours  
(Undergraduate)  
Design and implementation of telecommunication and network security infrastructure. This laboratory-based class includes the setup of realistic network infrastructure environment using bridges, routers, layer 2/3 switches and servers. Advanced routing infrastructure implementation using OSPF, RIPv2, EIGRP, BGP multi-homed BGP setups and IGP/EGP redistribution. Network infrastructure hardening using routers and switches. PREREQUISITE(S): TDC 365 or Instructor consent. Good knowledge of TCP/IP is required.

TDC 365 or Instructor consent is a prerequisite for this class. Good knowledge of TCP/IP is required.

TDC 384 | SCRIPTING FOR NETWORK MANAGEMENT | 4 quarter hours  
(Undergraduate)  
This is a hands-on course on using script languages to develop practical applications for Network Management. Students will first learn the fundamentals of Linux system and script language(s) for task automation, and use scripts to develop dynamic web sites. After that, the course will cover Simple Network Management Protocol (SNMP), and use Application Programming Interface (API) to automate networks tasks of Fault Management, Configuration Management, Accounting Management, Performance Management, and Security Management (FCAPS). The final project of the course is to develop a dynamic web site with the above five functional areas to manage Linux servers, Ethernet switches and IP routers. PREREQUISITE(S): IT 263. 
IT 263 is a prerequisite for this class.

TDC 390 | TOPICS IN NETWORK TECHNOLOGY | 1-4 quarter hours  
(Undergraduate)  
Specific topics will be selected by the instructor and will vary with each quarter. Prerequisite(s): See syllabus.

TDC 399 | INDEPENDENT STUDY | 1-4 quarter hours  
(Undergraduate)  
Independent study supervised by an instructor. Independent study form required. Can be repeated for credit. Variable credit. Prerequisite(s): None.

TDC 405 | VOICE AND DATA NETWORK FUNDAMENTALS | 4 quarter hours  
(Graduate)  
This course provides an introduction to voice and data networking technologies, including public and private voice services, Ethernet and Internet data technologies, network security, business applications and network management. The structure, regulation, and history of the telecom and data network industry will be discussed as well. PREREQUISITE(S): None.

TDC 411 | INTRODUCTION TO COMPUTER AND NETWORK SYSTEMS | 4 quarter hours  
(Graduate)  
This course is an introduction to computer architecture and operating systems with an emphasis on network systems. Topics covered include computer components and functions, logic circuits, process management, memory management, file management, interrupts and I/O peripheral devices, as well as computer networks, distributed systems, and network administration. Students will have several hands-on labs utilizing a Linux and Cisco IOS environment and will use Shell script for basic systems and network administration as well. PREREQUISITE(S): None.

TDC 413 | INTRODUCTION TO LAN AND WAN | 4 quarter hours  
(Graduate)  
This course covers the principles of local area network (LAN) and wide area network (WAN) technologies including structured cabling, protocols, network devices, and network operating systems. Students will learn the theories and practices of designing, provisioning, and deploying LAN and WAN in an enterprise environment. Assigned lab exercises involving LAN/WAN configuration and troubleshooting will help reinforce various concepts. PREREQUISITE(S): TDC 405.

TDC 431 | EMERGING WIRELESS AND MOBILITY NETWORKS | 4 quarter hours  
(Graduate)  
A study of evolving 2.5, 3rd & 4th Generation Wireless Networks, and disruptive technologies like WiFi(802.11), WiMax, Bluetooth, RFID, Ultra-Wideband and the security implications mobility networks. This course provides a balanced view of the Wireless Industry in transition, through evolving technology, regulation, competition and standards. Students will be better prepared to deal with the rapid changes and seize the opportunities as data mobility impacts traditional telecommunications and private networks. In addition students will have access to extensive Global Wireless Education Consortium materials to support their individual advanced interests. Formerly TDC 531. PREREQUISITE(S): TDC 405.

TDC 405 is a prerequisite for this class.

TDC 460 | FOUNDATIONS OF NETWORK TECHNOLOGIES | 4 quarter hours  
(Graduate)  
An introductory course on network technologies for local and wide area networks. The course examines in detail the core concepts for network architectures, Ethernet systems including wired, wireless, and Metro, virtual local area networks, storage area networks, optical networking, and the more traditional network services such as T1, frame relay, Asynchronous Transfer Mode (ATM), and SONET. PREREQUISITE(S): TDC 405 and TDC 413. 
TDC 405 and TDC 413 are prerequisites for this class.
TDC 463 | COMPUTER NETWORKS AND DATA SYSTEMS | 4 quarter hours
(Graduate)
A detailed discussion of the upper layers of network architectures. Network protocol organization will be discussed using TCP/IP as an example. IP addresses, subnetting, supernetting, and CIDR. Routing algorithms. Transport layer protocols. Application layer protocols. Introduction to IPv6. PREREQUISITE(S): TDC 405 and TDC 413.

TDC 405 and TDC 413 are prerequisites for this class.

TDC 464 | CONVERGED MULTIMEDIA NETWORKS | 4 quarter hours
(Graduate)
Exploration of multimedia networks including voice, data, and video services offered by network carriers and Internet Service Providers (ISP) to both enterprise and residential customers. The course starts with an overview of current voice and data networks and presents the driving forces leading to a converged multimedia network. The focus is on Voice over IP (VoIP), including signaling, protocols, equipment, network architecture/design, traffic engineering, and service deployment strategy. PREREQUISITE(S): TDC 413.

TDC 413 is a prerequisite for this class.

TDC 466 | NETWORK PROGRAMMING | 4 quarter hours
(Graduate)
The course covers the basic and advanced issues of TCP/IP networking programming such as multiple processes, I/O multiplexing, multi-threaded processes, multicasting and secure network programming USING C/C++. Application examples such as Internet browsing, instant messaging, proxy filtering and file transfer protocols are discussed. PREREQUISITE(S): (TDC 463 OR CSC 435) and CSC 404.

(TDC 463 OR CSC 435) and CSC 404 are prerequisites for this class.

TDC 477 | NETWORK SECURITY | 4 quarter hours
(Graduate)
Network infrastructure security issues, including perimeter security defense, firewalls, Virtual Private Networks, Intrusion Detection Systems, wireless security, network security auditing tools and ethical considerations. Strategies for the deployment of "Defense-In-Depth" mechanisms in an enterprise computing environment. PREREQUISITE(S): TDC 463 or CSC 435.

TDC 463 or CSC 435 is a prerequisite for this class.

TDC 478 | INFORMATION STORAGE AND MANAGEMENT | 4 quarter hours
(Graduate)
This is a hands-on course on using script languages to develop practical applications for Network Management. Students will first learn the fundamentals of Linux system and script language(s) for task automation, and use scripts to develop dynamic web sites. After that, the course will cover Simple Network Management Protocol (SNMP), and use Application Programming Interface (API) to automate networks tasks of Fault Management, Configuration Management, Accounting Management, Performance Management, and Security Management (FCAPS). The final project of the course is to develop a dynamic web site with the above five functional areas to manage Linux servers, Ethernet switches and IP routers. PREREQUISITE(S): TDC 413.

TDC 413 is a prerequisite for this class.

TDC 484 | SCRIPTING FOR NETWORK MANAGEMENT | 4 quarter hours
(Graduate)
This is a hands-on course on using script languages to develop practical applications for Network Management. Students will first learn the fundamentals of Linux system and script language(s) for task automation, and use scripts to develop dynamic web sites. After that, the course will cover Simple Network Management Protocol (SNMP), and use Application Programming Interface (API) to automate networks tasks of Fault Management, Configuration Management, Accounting Management, Performance Management, and Security Management (FCAPS). The final project of the course is to develop a dynamic web site with the above five functional areas to manage Linux servers, Ethernet switches and IP routers. PREREQUISITE(S): TDC 413.

TDC 413 is a prerequisite for this class.

TDC 511 | TELECOMMUNICATIONS PRACTICUM | 4 quarter hours
(Graduate)
Introduction to the design and management of data networks for the enterprise environment. Network design includes physical design, logical design, LAN, WAN, and experimental design. Network managements includes switch, router, and firewall configuration, SNMP configuration, performance measurement, and network trouble shooting. Students will have many hands-on lab exercises to strengthen their learning of network concepts. PREREQUISITE(S): TDC 411 and TDC 460 and TDC 463.

TDC 411 and TDC 460 and TDC 463 are prerequisites for this class.

TDC 512 | CELLULAR AND WIRELESS TELECOMMUNICATIONS | 4 quarter hours
(Graduate)
A survey course which includes an overview of all the design and network elements that comprise the foundation of today's cellular networks. Topics include the evolution of cellular technology; basic cellular design and operation principles; cell base station design and function; a review of digital wireless technologies; radio frequency (RF) and antenna propagation basics; an overview of towers; microwave radio systems; roaming and intercarrier networking; the business side of wireless and landline interconnection to the Public Switched Telephone Network (PSTN). PREREQUISITE(S): TDC 464.

TDC 464 is a prerequisite for this class.

TDC 514 | COMPUTER TELEPHONY | 4 quarter hours
(Graduate)
A study of enabling technologies allowing the integration of voice communications services with personal computers, LANs and mainframes. Telephony programming interfaces, call management software, intelligent fax/data retrieval and interactive voice response systems will be considered. PREREQUISITE(S): TDC 463 and TDC 464.

TDC 463 and TDC 464 are prerequisites for this class.

TDC 532 | WIRELESS SYSTEM ENGINEERING AND DEPLOYMENT | 4 quarter hours
(Graduate)
An advanced course in cellular communications with an emphasis on LTE-Advanced and 3GPP technologies. Topics include Cellular IoT (CIoT), Network Slicing, LTE support for V2x services, advanced carrier aggregation, and enhanced Licensed Assisted Access (eLAA). Students will work on applied assignments using the LTE equipment in the 5G DemoLab. PREREQUISITE(S): TDC 512.

TDC 512 is a prerequisite for this class.
TDC 463 is a prerequisite for this class.

Architectures are also discussed. PREREQUISITE(S): TDC 463.

Performance monitoring, service level agreements and network security and isolation, event correlation, MIB design, SNMP programming, management—are discussed. Advanced topics such as fault diagnosis, performance management, security, accounting and configuration.

The five major areas of network management—fault management, traffic engineering, network planning and simulation using simulation tools, and packet management techniques. PREREQUISITE(S): TDC 460 AND TDC 463.

TDC 460 and TDC 463 are prerequisites for this class.

TDC 562 | COMPUTER-COMMUNICATION NETWORK DESIGN & ANALYSIS | 4 quarter hours

This course provides an in-depth study of Internet protocols from the perspective of network planning, simulation and troubleshooting. The course includes in-depth study of Internet traffic, traffic measurement techniques, network planning and simulation using simulation tools, and packet management techniques. PREREQUISITE(S): TDC 463.

TDC 463 is a prerequisite for this class.

TDC 563 | PROTOCOLS AND TECHNIQUES FOR DATA NETWORKS | 4 quarter hours

Advanced topics in TCP/IP including in-depth study of IPv6, TCP traffic control, and routing protocols; multicast routing protocols; upper layer protocols supporting Quality of Service (QoS); Software Defined Network (SDN); data compression techniques; and other advances in networking technologies. PREREQUISITE(S): TDC 463.

TDC 463 is a prerequisite for this class.

TDC 567 | TELECOMMUNICATION SYSTEMS DESIGN AND MANAGEMENT | 4 quarter hours

The theory and practice of Telecommunication system design. Ongoing systems management. Telecommunication management including selection of vendors/systems, structuring an RFP systems proposal analysis, computer aided telecommunications management. Telecommunication management strategies from a business perspective. PREREQUISITE(S): TDC 463.

TDC 463 is a prerequisite for this class.

TDC 568 | NETWORK MANAGEMENT | 4 quarter hours

The five major areas of network management—fault management, performance management, security, accounting and configuration management—are discussed. Advanced topics such as fault diagnosis and isolation, event correlation, MIB design, SNMP programming, performance monitoring, service level agreements and network security architectures are also discussed. PREREQUISITE(S): TDC 463.

TDC 463 is a prerequisite for this class.

TDC 577 | NETWORK SECURITY II | 4 quarter hours

This course is an advanced class in network security. Topics include: Intrusion Detection and Prevention Systems; Security Engineering processes; Advanced firewall considerations; Honeypots; Incident response; Forensics; Enterprise security policy development and complex enterprise security infrastructure design and integration. PREREQUISITE(S) TDC 477.

TDC 477 is a prerequisite for this class.

TDC 593 | TOPICS IN NETWORK ENGINEERING AND SECURITY | 4 quarter hours

Specific topics will be selected by the instructor and will vary with each quarter. Prerequisite(s): See syllabus.

TDC 594 | NETWORK CAPSTONE | 4 quarter hours

In this class students will synthesize knowledge from previous courses to design, build, test, and demonstrate a comprehensive network project as members of a project team. Topics introduced or reviewed, and used in completing the project, will include network requirement analysis, network architecture design, vendor evaluation, planning, experimental design, physical design, logical design, security design, testing strategy, documentation, change management, and network management strategy. Other topics include reasoning about uncertain user requirements, negotiation, online meeting techniques, and group dynamics. PREREQUISITE(S): TDC 477 and TDC 511.

TDC 599 | INDEPENDENT STUDY | 1-8 quarter hours

Independent study supervised by an instructor. Independent study form required. Can be repeated for credit. (variable credit)

TDC 690 | RESEARCH SEMINAR | 1-4 quarter hours

Readings and discussion on current research topics. Students may register for this course no more than twice. PREREQUISITE(S): Consent of the instructor. (variable credit)

TDC 696 | MASTER'S PROJECT | 4 quarter hours

(4 credit hours) Students may register for this course only after their advisor has approved a written proposal for their project. PREREQUISITE(S): Consent of advisor. Independent study form required.

TDC 698 | MASTER'S THESIS | 2 quarter hours

Students may register for this course only after their advisor has approved a written proposal for their thesis. Students must continue to register for this course every quarter after their first registration in it until they complete their project or thesis to the satisfaction of their advisor. They earn two hours of credit for each such registration but only four hours of credit will apply for degree credit. PREREQUISITE(S): Consent of advisor. Independent study form required. (2 quarter hours)