NETWORK TECHNOLOGIES (NET)

NET 261 | BASIC COMMUNICATION SYSTEMS (FORMERLY TDC 261) | 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.

NET 311 | COMPUTERS IN TELECOMMUNICATIONS SYSTEMS (FORMERLY TDC 311) | 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.
IT 263 and (IT 211 or CSC 241 or CSC 243) are prerequisites for this class.

NET 351 | NETWORKING FOR THE INTERNET OF THINGS | 4 quarter hours
(Undergraduate)
This course will cover networking for low-power devices, focusing on the Internet of Things (IoT). Our emphasis will be on energy-efficient network design and implementation, and topics will cover design challenges in scalability, interoperability, and performance evaluation. This course will establish foundations for leveraging Cloud Computing variants (Fog, Cloudlets and Cloud) for improving network operation and IoT data management. Students will learn how to formally model and design protocols for IoT systems, and gain practical experience in developing IoT prototypes in a course-long team-based project. The course will also cover recent developments in Cellular IoT infrastructures, and will address security vulnerabilities and challenges in CPS systems. The broader scope of Cyber Physical Systems (CPS) will be addressed both in design and integration with IoT systems.
IT 263 is a prerequisite for this class.

NET 362 | PRINCIPLES OF DATA COMMUNICATIONS (FORMERLY TDC 362) | 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.
(NET 311 or CSC 373) and (IT 263 or NET 261) are prerequisites for this class.

NET 363 | INTRODUCTION TO LOCAL AREA NETWORKS (FORMERLY TDC 363) | 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.
NET 261 or IT 263 is the prerequisite for this class.

NET 364 | VOICE COMMUNICATIONS TECHNOLOGIES (FORMERLY TDC 364) | 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.
IT 263 is a prerequisite for this class.

NET 365 | NETWORK INTERCONNECTION TECHNOLOGIES (FORMERLY TDC 365) | 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.
NET 363 is a prerequisite for this class.

NET 368 | NETWORK PROGRAMMING (FORMERLY TDC 368) | 4 quarter hours
(Undergraduate)
Programming distributed client/s erver applications; the sockets interface and multitasking issues; client/server models; remote procedure call; examples of applications such as electronic mail and file transfer.
CSC 309 is a prerequisite for this class.

NET 369 | NETWORK PERFORMANCE ANALYSIS AND DESIGN (FORMERLY TDC 369) | 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.

NET 371 | WIRELESS COMMUNICATIONS NETWORKS (FORMERLY TDC 371) | 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.
NET 261 or IT 263 is the prerequisite for this class.

NET 372 | WAN SERVICES (FORMERLY TDC 372) | 4 quarter hours
(Undergraduate)
A survey of Wide Area Network services used to securely access and interconnect business network services. Topics will include T-carrier and SONET transport, Digital Subscriber Line (DSL), and wireless data access methods, as well as Multi-Protocol Label Switching, Virtual Private Networks and Software Defined Networks.
NET 365 is a prerequisite for this class.

NET 375 | NETWORK PROTOCOLS (FORMERLY TDC 375) | 4 quarter hours
(Undergraduate)
Advanced routing technologies, BGP protocols, multi-area routing protocols, network management protocols, Secure protocols, IP multicasting protocols.
NET 365 is a prerequisite for this class.

NET 376 | NETWORK PROJECT (FORMERLY TDC 376) | 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.
NET 377

NET 377 | FUNDAMENTALS OF NETWORK SECURITY (FORMERLY TDC 377) | 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.
NET 365 is a prerequisite for this class.

NET 378 | INFORMATION STORAGE AND MANAGEMENT (FORMERLY TDC 378) | 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.

NET 379 | TELECOMMUNICATION AND NETWORK SECURITY PRACTICUM (FORMERLY TDC 379) | 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.
NET 365 or Instructor consent is a prerequisite for this class. Good knowledge of TCP/IP is required.

NET 384 | SCRIPTING FOR NETWORK MANAGEMENT (FORMERLY TDC 384) | 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.
NET 311 or CSEC 378 is a prerequisite for this class.

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

NET 399 | INDEPENDENT STUDY (FORMERLY TDC 399) | 1-4 quarter hours
(Undergraduate)
Independent study supervised by an instructor. Independent study form required. Can be repeated for credit. Variable credit.

NET 405 | NETWORK FUNDAMENTALS (FORMERLY TDC 405) | 4 quarter hours
(Graduate)
This course provides an introduction to data networking technologies, including Ethernet and Internet data technologies, network security, business applications and network management.

NET 411 | INTRODUCTION TO COMPUTER AND NETWORK SYSTEMS (FORMERLY TDC 411) | 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.

NET 413 | INTRODUCTION TO LAN TECHNOLOGIES (FORMERLY TDC 413) | 4 quarter hours
(Graduate)
This course covers the principles of local area network (LAN) technologies including structured cabling, protocols, network devices, and network operating systems. Students will learn the theories and practices of designing, provisioning, and deploying LAN technologies in an enterprise environment.
NET 405 is a prerequisite for this class.

NET 431 | EMERGING WIRELESS AND MOBILITY NETWORKS (FORMERLY TDC 431) | 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.
NET 413 is a prerequisite for this class.

NET 451 | NETWORKING FOR THE INTERNET OF THINGS | 4 quarter hours
(Graduate)
This course will delve into the design and modelling of Internet of Things (IoT) devices. The course will focus on the inherent challenges in designing low-power communication systems, and cover a number of leading architectures, standards and interfaces for IoT networks. The emphasis will be on energy-efficient network design and implementation, and topics will cover design challenges in scalability, interoperability, and performance evaluation. The topics will include formal design and modelling in IoT systems, including the use of Resource Description Framework (RDF). The topics covering IoT operation will build on prominent supporting technologies, such as Cloud/Edge computing and Information Centric Networks. Students will gain practical experience in developing IoT prototypes in a course-long team-based project. The course will also cover recent developments in Cellular IoT infrastructures, and will address security vulnerabilities and challenges in IoT systems.
NET 413 is a prerequisite for this class.

NET 460 | FOUNDATIONS OF NETWORK TECHNOLOGIES (FORMERLY TDC 460) | 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 T-1, frame relay, Asynchronous Transfer Mode (ATM), and SONET.
NET 405 and NET 413 are prerequisites for this class.

NET 463 | COMPUTER NETWORKS AND DATA SYSTEMS (FORMERLY TDC 463) | 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.
NET 405 and NET 413 are prerequisites for this class.

NET 464 | CONVERGED MULTIMEDIA NETWORKS (FORMERLY TDC 464) | 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.
NET 413 is a prerequisite for this class.

NET 468 | NETWORK PROGRAMMING (FORMERLY TDC 468) | 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.
(NET 463 OR CSC 435) and CSC 404 are prerequisites for this class.

NET 477 | NETWORK SECURITY (FORMERLY TDC 477) | 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.
NET 463 or CSC 435 is a prerequisite for this class.

NET 478 | INFORMATION STORAGE AND MANAGEMENT (FORMERLY TDC 478) | 4 quarter hours
(Graduate)
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.

NET 484 | SCRIPTING FOR NETWORK MANAGEMENT (FORMERLY TDC 484) | 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.
NET 411 and NET 413 are prerequisites for this class.

NET 511 | TELECOMMUNICATIONS PRACTICUM (FORMERLY TDC 511) | 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.
NET 463 is a prerequiste for this class.

NET 512 | CELLULAR AND WIRELESS TELECOMMUNICATIONS (FORMERLY TDC 512) | 4 quarter hours
(Graduate)
An introductory course in cellular and wireless communications with an emphasis in 4G Long Term Evolution (LTE) and LTE-Advanced cellular networks. Topics include principles of digital wireless communications, cellular architecture, radio access deployment, core network deployment, subscriber management, mobility and session management, security, roaming, interconnection, Self-Optimizing Networks (SON), Voice over LTE (VoLTE), and LTE-Advanced upgrades. Student lab assignments may use LTE network equipment deployed in the School of Computing De-Mobile Lab.
NET 464 is a prerequisite for this class.

NET 514 | COMPUTER TELEPHONY (FORMERLY TDC 514) | 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.
NET 463 and NET 464 are prerequisites for this class.

NET 532 | WIRELESS SYSTEM ENGINEERING AND DEPLOYMENT (FORMERLY TDC 532) | 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 De-Mobile Lab.
NET 512 is a prerequisite for this class.

NET 542 | PROTOCOLS FOR ADVANCED WIRELESS NETWORKS (FORMERLY TDC 542) | 4 quarter hours
(Graduate)
This course provides students with an in-depth study of the advanced wireless communication protocols and technologies. It starts with an overview of the wireless evolution from the first generation network to the modern and future wireless technologies. It will then go on to explore major aspects of each advanced wireless technology: air interface, smart antennas, network infrastructure, network elements and their functions, QoS, security, mobility, and performance. Wireless protocols, including both User-to-Network Interface (UNI) and Network-to-Network Interface (NNI), are also studied in detail. Students will also learn new service opportunities provided by these advanced wireless technologies.
NET 512 is a prerequisite for this class.

NET 560 | ADVANCED NETWORK TECHNOLOGIES AND DESIGN (FORMERLY TDC 560) | 4 quarter hours
(Graduate)
This course introduces advanced network technologies and design, including Multi-Protocol Label Switching (MPLS), MPLS Virtual Private Networks, IP storage networks, content distribution, capacity planning and traffic engineering.
NET 460 and NET 463 are prerequisites for this class.

NET 562 | COMPUTER-COMMUNICATION NETWORK DESIGN & ANALYSIS (FORMERLY TDC 562) | 4 quarter hours
(Graduate)
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.
NET 411 and NET 460 and NET 463 are prerequisites for this class.

NET 563 | PROTOCOLS AND TECHNIQUES FOR DATA NETWORKS (FORMERLY TDC 563) | 4 quarter hours
(Graduate)
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.
NET 411 and NET 460 and NET 463 are prerequisites for this class.

NET 567 | TELECOMMUNICATION SYSTEMS DESIGN AND MANAGEMENT (FORMERLY TDC 567) | 4 quarter hours
(Graduate)
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.
NET 411 and NET 460 and NET 463 are prerequisites for this class.

NET 568 | NETWORK MANAGEMENT (FORMERLY TDC 568) | 4 quarter hours
(Graduate)
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.
NET 411 and NET 460 and NET 463 are prerequisites for this class.

NET 577 | NETWORK SECURITY II (FORMERLY TDC 577) | 4 quarter hours
(Graduate)
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.
NET 477 is a prerequisite for this class.

NET 593 | TOPICS IN NETWORK ENGINEERING AND SECURITY (FORMERLY TDC 593) | 4 quarter hours
(Graduate)
Specific topics will be selected by the instructor and will vary with each quarter. Prerequisite(s): See syllabus.

NET 594 | NETWORK CAPSTONE (FORMERLY TDC 594) | 4 quarter hours (Graduate)
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.
NET 477 and NET 511 are prerequisites for this class.