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**TELE 5330. Data Networking. 4 Hours.**
Provides the basics of data networking protocols and architectures. Topics include protocol architecture of the internet; application protocols such as FTP, SMTP, and HTTP; web caching, DNS, CDNs, and P2P applications; use of TCP and UDP socket programming to develop network applications in Python; transport protocols, including TCP, UDP, and TCP congestion control; IP protocol, addressing, IPv4 and v6, NATs, ICMP and tunnels; routing algorithms and OSPF; data link protocols, encoding, framing, error control, and PPP; switched LANs, ARP, Ethernet, and VLANs; wireless LANs and 802.11 protocols; and network security—encryption, message integrity, authentication protocols, key management, SSL/TLS, IPsec, and 802.11i.

**TELE 5331. Lab for TELE 5330. 0 Hours.**
Addresses a range of networking components, including routers, switches, and Linux servers, and how they are configured to create a virtual environment. Covers the installation and configuration of networking concepts such as DNS, DHCP, and firewalls and the creation of virtual environments. Requires students, working in teams, to configure one or more components; the teams then must interconnect the components to form a small network. In the process of configuration and integration, students are exposed to troubleshooting at various protocol layers and have an opportunity to become familiarized with different operating systems and networking tools.

**TELE 5340. Telecommunications Public Policy and Business Management. 4 Hours.**
Introduces students to business management issues, such as basic accounting, finance, marketing, and operations in the telecommunications field, and also topics such as the time value of money and decision making. Also includes issues of human relations, organizational behavior, and business strategy. Provides an understanding of the regulatory environment of the telecommunications industry. Topics include universal service, service quality tariffs, the Modified Final Judgment and Telecom Act of 1996, market restrictions and segmentation, the current competitive environment in the United States and internationally, interconnection including unbundling, collocation, economic issues, and global trends in market reform.

**TELE 5350. Telecom and Network Infrastructure. 4 Hours.**
Provides in-depth treatment of the wireline and wireless infrastructure of the network supporting all telecommunication, internet, and enterprise applications. Covers the basics of communications—source coding, baseband and broadband modulation and transmission, channel coding, spread-spectrum, multiuser radio communications, radio link analysis, and propagation. Also covers the wireline core network—digital and optical transmission, framing, network synchronization, asynchronous and synchronous multiplexing, cross connects, SONET/SDH, DWDM, OTN, protection switching, and network availability. Addresses wireline (DSL, digital cable, FTTx, PONs) and wireless access (cellular, Wi-Fi), frequency reuse, and handoff. Also addresses support of data transport (switched Ethernet, VLAN, IP, MPLS) and application networks (PSTN, mobile core, internet, IPTV, and virtual networks).

**TELE 5360. Internet Protocols and Architecture. 4 Hours.**
Offers in-depth treatment of protocols used in the internet, wireless access, and enterprise networks. Topics include protocols for network layer QoS (including DiffServ, ECN, RSVP, MPLS); protocols for security, including both access control and network-level security (e.g., X.509, SSL/TLS, IPsec, IKE, EAP); protocols for interdomain routing (BGP); protocols to support multicast, broadcast, and streaming applications; protocols to support host mobility, large server deployments, content distribution, and enterprise networks (VLANs, etc); and protocols to support IPv6 (e.g., address assignment) and its interoperability with IPv4. Also covers network design architectures for cloud computing, data centers, content distribution, layer-2 networks, etc. Discusses general scaling issues for large networks.

**TELE 5600. Linux/UNIX Systems Management for Network Engineers. 4 Hours.**
Introduces UNIX/Linux in a networking/Internet environment. Covers operating system concepts, tools, and utilities; networking and security issues; and data and text processing using scripts and filters. Addresses basic administrative tasks such as managing users, file systems, security, and software. Covers networking topics such as network configuration, daemon processes, SSH, DNS, DHCP, diagnostic tools, and the use of scripts and automation to manage applications and systems, as well as security topics such as name and authentication services, access control lists, file modification protections, and firewalls.

**TELE 5976. Directed Study. 1-4 Hours.**
Offers independent work under the direction of members of the department on a chosen topic. Course content depends on instructor. May be repeated without limit.

**TELE 5978. Independent Study. 1-4 Hours.**
Offers work performed under individual faculty supervision. May be repeated without limit.

**TELE 6100. Mobile Wireless Communications and Networking. 4 Hours.**
Studies communications and networking issues in providing broadband wireless access to mobile applications. Discusses networking technologies required by converged IP-based applications. Covers converged network architectures and the interworking of different generations of access technologies with the Evolved Packet Core (EPC). Registration limited and by application only; it is expected that all students have prior knowledge of digital communications, radio propagation, cellular networks, and second-generation wireless standards.

**TELE 6350. IP Telephony. 4 Hours.**
Provides a comprehensive overview of IP telephony architectures and protocols, with emphasis on SIP the Session Initiation Protocol. Topics include a review of classical circuit-switched telephony, especially signaling; a review of IP networking, especially routing and addressing; peer and master-slave protocols for IP telephony (SIP, H.323, MGCP); speech coding; the transport of real-time traffic over IP (RTP and RTCP); bandwidth control; issues in network quality of service, such as traffic modeling, dimensioning, and QoS mechanisms; IMS; messaging protocols and systems; WebRTC, browser, and API-driven telephony applications; and Unified Communications. The emphasis on SIP includes call flows, network components, and services. Focuses on execution of labs and semester-long projects to provide hands-on learning in a small team environment.
TELE 6400. Software-Defined Networking. 4 Hours.
Introduces the foundational theories and technologies of software-defined networking (SDN), a new paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire physical network. Discusses SDN technologies, such as the OpenFlow specification and OpenDaylight controller, and introduces students to SDN applications and network function virtualization (NFV). Offers hands-on exposure to popular open-source software and technologies through student projects. Requires good knowledge of Java or Python.

TELE 6603. Special Topics—Networking. 1-4 Hours.
Description to come. May be repeated up to eight times.

TELE 6945. Master's Project. 4 Hours.
Offers theoretical or experimental work under individual faculty supervision.

TELE 6962. Elective. 1-4 Hours.
Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

TELE 6964. Co-op Work Experience. 0 Hours.
Provides eligible students with an opportunity for work experience. May be repeated without limit.

TELE 6965. Co-op Work Experience Abroad. 0 Hours.
Provides eligible students with an opportunity for work experience abroad. May be repeated without limit.