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Course Purpose:
Introduction to analysis and design of computer and communication networks through understanding the network layered architecture and the protocol stack and by conducting hands-on programming and lab activities.

Course Topics:

- Understanding network architectures, protocol layers, and their service models.

- Principles of network applications:
  - Application layer protocols such as HTTP, FTP, and SMTP.
  - Peer-to-Peer File Sharing Protocols and Architectures.
  - ISPs and Domain name systems.
  - Socket API and network socket programming.

- Understanding reliable and unreliable transport-layer protocols:
  - GBN and SR. TCP and UDP. Port numbers.
  - Multiplexing and demultiplexing.
  - Flow control and congestion control. Fairness.
  - Delay, jitter, and loss in packet-switched networks.
  - Bandwidth, throughput, and quality-of-service.

- Understanding network layer services and protocols:
  - Switching fabric:
  - Routing and forwarding.
  - Queues and buffering.
  - Virtual-circuit and datagram networks.
  - Internet protocol. IPv4 and IPv6. Tunneling.
  - LS and DV algorithms.
  - Routing in the Internet. RIP, OSPF, and BGP.
  - Broadcast and multicast.
  - Handling mobility.

- Understanding network layer services and protocols:
Link-layer and its services.
- Ethernet, hubs, bridges, and switches.
- Link-layer addressing.
- Error-detection and error-correction. Parity, check-summing, CRC.
- Manchester encoding. ATM and MPLS.
- Local area networks and IEEE 802.11 wireless LANs.
- Multiple-access protocols. Random access.
- Efficiency of pure and slotted ALOHA. CSMA, CSMA/CD, and CSMA/CA.

Introduction to physical-layer services and systems:
- Introduction to physical media.
- Coax, fiber, twisted pair, DSL, HFC.
- WiMax, cellular, satellite, and telephone networks.
- Bit transmission.
- Frequency division multiplexing. Time division multiplexing.

Prerequisites:

ECE 1305 or CS 1412 and MATH 3342 and ECE 3303

Hands-on Activities:

Extensive Network Socket Programming using Java
- Multi-threaded Web Server
- E-Mail Client
- UDP Pinger
- Web Proxy Server
- Reliable Transport Protocol

Extensive WireShark (Packet Sniffer) Lab Experiments
- Exploring HTTP
- Exploring DNS
- Exploring TCP
- Exploring UDP
- Exploring ICMP
- Exploring Ethernet and IEEE 802.3

Textbook: