

COLLEGE OF ELECTRICAL AND MECHANICAL ENGINEERING
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY

Title : **CSE 850 Advanced Computer Networks**

Credits : **3**

Objective: This graduate course deals with the principles, algorithms, protocols and architectures related to the advancement in some key areas of computer networks. A strong emphasis will be placed on the protocols used in the Internet. The focus will be on Internet Architecture, Network Application and Transport Protocols, IP routing (OSPF, BGP, and Multicast Routing), Congestion Control, Quality of Service, Traffic Engineering, Peer-to-Peer Systems, Network Security, and Network Management. The course is structured to lead from theory to practical solutions and discussion on their deployment issues. The course assumes basic working knowledge of IP protocols, especially an understanding of IP routing.

Course: Introduction: Internet Architecture, End-to-End principle and Internet design, Emerging Data Link and Physical Layer Technologies (3 hrs)
Applications: HTTP, FTP, DNS, SMTP, Overlay Networks and Peer-to-Peer (P2P) Systems, P2P File Sharing (3 hrs)
Transport: Transport Services, TCP and UDP (3 hrs)
IP Routing: IP Addressing, Overview of Internet Protocols (e.g. IP, ICMP), Distance Vector, Link-State (OSPF), BGP, Multicast routing. (6 hrs)
Congestion Control: Open-loop (Policing and Shaping), Closed-loop (TCP congestion control algorithms - Reno, Tahoe, Vegas); Network Assisted – ECN; Active Queue Management (RED). (6 hrs)
IP QoS: QoS Schedulers (WFQ, DRR, PQ), IP QoS Architectures, IntServ and RSVP, DiffServ, Router Design for IP QoS, Policy-based QoS Management. (6 hrs)
Traffic Engineering: Principles of IP Traffic Engineering, MPLS. (3 hrs)
Multimedia Networking: Multimedia Applications, Protocols for Multimedia Support, RTP, RTCP, RTSP (3 hrs)
Network Management: Network management framework, SNMP, ASN (3 hrs)
Network Security: Cryptography, Symmetric Key Algorithms, Public Key Algorithms, Digital Signatures, Management of Public Keys, Communication Security, IPsec, Firewalls, VPNs, Authentication Protocols. (6 hrs)
Network Simulation and Analysis: Simulation Modeling, System Performance Evaluation, Traffic Analysis and Optimization, Network Simulators (3 hrs)

Texts: 1. J. Kurose and K. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, 3/e, Addison-Wesley, 2005.

References:

1. A. Leon-Garcia and I. Widjaja, “Communication Networks – Fundamental Concepts and Key Architectures”, Second Edition, McGraw Hill, 2002.
2. L. Peterson and B. Davie, “Computer Networks – A Systems Approach”, Morgan Kaufmann, 2002.
3. Andrew S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice Hall, 2003.
4. Behrouz A. Forouzan, “Data Communications and Networking”, Third Edition, McGraw Hill, 2003.

Prerequisites: Data Communication and Computer Networks