**ECE PhD Screening Exam Topics: Network Engineering**

Probability. Random variables. Cumulative distribution function. Probability density function. Discrete and continuous random variables. Bernoulli, geometric, uniform, exponential, Poisson random variables. Continuous-time Markov chain. Queuing theory. Little's theorem. M/M/1 queue.

The seven-layer OSI model. Protocols and architectures.

Data communication techniques. The transmission medium: guided and wireless. Baseband and broadband transmission. Digital modulation and multiplexing. Asynchronous and synchronous transmission.

Error control in data communication networks. Flow control. Errors in transmission. Error detection techniques. Parity checks and CRC. Error control. Sliding window, go-back-N and selective reject protocols. Automatic repeat request (ARQ).

Data link control. The data link layer and its sublayers. Data link control protocols: HDLC, LLC and PPP.

Local area networks. LANs and MANs. Topologies. CSMA/CD. Medium access control protocols. Ethernet and token ring. Performance analysis. High-speed LANs. Wireless LANs. Interconnection of LANs: repeaters and bridges. Spanning tree loop resolution. Layer 2 switching.

Wide area networks. Circuit switching. Packet switching. Virtual circuits. Effects of congestion and congestion control in packet switched networks.

Internetworking. Principles of internetworking: repeaters, bridges, routers, switches, gateways and portals. LANs, WANs, and the Internet. Routing in packet switched networks. Dijkstra’s and Bellman-Ford algorithms.

Internet protocol. The TCP/IP protocol suite. Network services. IP and ICMP. ARP. IP addresses. IPv4 and IPv6. DHCP. Routing protocols. RIP. OSPF. Autonomous systems. Multicasting. BGP. Domain name system (DNS).

Transport Protocols. Transport services. Protocol mechanisms. TCP and UDP. TCP congestion control.

End-to-end Protocols and Services. File access and transfer. Electronic mail. SNMP. Worldwide web, HTTP, HTML, XML. Peer-to-peer. Service oriented architecture. Multimedia and integration of services.

Network security. Security requirements: confidentiality, integrity, availability, authenticity. Passive and active attacks. Symmetric encryption model. Public key encryption and message authentication. VPN and IPSec. Secure socket layer and transport layer security.

Client server model of communication. Sockets, ports, and connections. Sockets elements.

McEachen/Tummala

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**Note:** This list is provided only as a guideline to the student and may not be completely comprehensive. Examiners reserve the right to determine specific areas of concentration, and students may be examined on any topic that broadly relates to the area.