1. Course Number and Course Title:

COE 530 - Advanced Computer Networks

2. Credit Hours:

3 - 0 - 3

3. Prerequisites and/or Co-Requisites:

Prerequisite: Approval of the CSE Head of Department Co-requisites: None Competencies: Undergraduate-level knowledge of computer networks.

4. Name and Contact Information of Instructor:

Name: Dr. Rana E. Ahmed

5. Course Description (Catalog Description):

Focuses on advanced topics in computer networking and performance modeling. Covers the following: Performance modeling and simulation, congestion control and quality of service (QoS) techniques, overview of computer networks security, and recent advances in computer networks.

6. Textbook and other Supplemental Material:

Textbook:

• Kurose J. F. and Ross K. W., *Computer Networking: A Top-Down Approach*, Pearson, Seventh Edition, 2017.

Other supplemental material:

- Gebali, F., *Analysis of Computer Networks*, Springer, 2nd ed., 2015.
- Hayes J. F., and Ganesh Babu T., *Modeling and Analysis of Telecommunications Networks*, John Wiley and Sons, 2004.
- Trivedi K. S., *Probability and Statistics with Reliability, Queuing, and Computer Science Applications*, John Wiley and Sons, 2nd ed., 2001.
- Computer network modeling and simulation software packages, including NS-3, Matlab, Riverbed and JMT (available at AUS or free).
- Recently published journal and conference papers on the subject.

7. Course Learning Outcomes:

Upon completion of the course, students will be able to:

- 1. Demonstrate a deep understanding of key principles in computer networking such as reliable data transfer, congestion control, and network security.
- 2. Develop queuing models suitable for the performance evaluation of computer networks.
- 3. Calculate delay and other performance metrics in packet-switched and circuit-switched networks.
- 4. Simulate networking scenarios and estimate various performance metrics.
- 5. Conduct independent research on recent topics in computer networking.

8. Teaching and Learning Methodologies:

Methods include lectures, problem and project-based learning methods (assignments, exams, survey paper, research project), and class discussions.

9. Course Topics and Schedule

Topic/Activity	Weeks
Introduction: computer networks, internet, protocols	Week 1
Network Performance Metrics; Stochastic Processes	Week 2
Queueing models	Week 3
Application of queueing theory to computer networks and protocols	Week 4
Simulation methodologies; Discrete-event simulation; Simulation output	Week 5
analysis	
Simulation models for computer networks and protocols	Week 6
Congestion control strategies in networks	Week 7
TCP congestion control + Midterm exam	Week 8
Quality-of-Service (QoS) approaches; IntServ; DiffServ	Week 9
Security techniques in computer networks; cryptography; digital signatures	Week 10
End-to-end authentication; securing TCP connections	Week 11
Network-layer security; IPsec; VPN	Week 12
Recent advances in wireless and mobile networks	Week 13
Recent advances in multimedia and optical networks	Week 14
Review and evaluation, project demos	Week 15
Final Exam	Week 16