1. **Course Number and Course Title:**
   COE 630 – Wireless 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):**
   Explores advanced concepts in wireless networking and mobile communications. Covers recent technologies and trends in signal propagation, wireless local area networks, cellular networks, vehicular networks, sensor networks, wireless personal-area networks, low-power wide-area networks, Internet of Things, cognitive radio, and mobility management.

6. **Textbook and other Supplemental Material:**
   Textbook:
   - Agrawal D., and Zeng Q, *Introduction to Wireless and Mobile Systems*, 4th Edition, 2016, Cengage Learning.

   Other supplemental material:
   - Beard C., and Stallings W., *Wireless Communications Networks and Systems*, 2016, Pearson.
   - Tripathi, N. D., and Reed, J.H., *Cellular Communications: A Comprehensive and Practical Guide*, 2014, IEEE and Wiley.
   - Cox C., *An introduction to LTE : LTE, LTE-Advanced, SAE, VoLTE and 4G mobile communications*, Second Edition, 2014, John Wiley.
   - Rodriguez J. (Ed.) , *Fundamentals of 5G Mobile Networks*, 2015, Wiley.
   - Abu-Rgheff, M. A., *5G Physical Layer Technologies*, 2019, Wiley-IEEE Press.
   - Computer network modeling and simulation software packages, including NS-3, Matlab, and Riverbed (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. Perform link budget calculations in wireless environment
2. Evaluate delay-throughput performance of various multiple access schemes employed in wireless networks
3. Evaluate design methodologies in cellular wireless networks, including cell planning, capacity planning, and resource allocation schemes.
4. Assess various low-power wide-area and vehicular network technologies for their suitability for IoT communications within smart city context.
5. Evaluate the performance of low-power personal area network technologies for healthcare, surveillance and safety applications.
6. Simulate various wireless networking scenarios and estimate performance metrics.
7. Conduct independent research on recent topics in wireless 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**
RF Propagation; Wireless Channel Models	Week 1
Link Budget Calculations	Week 2
Antennas; Diversity Techniques; MIMO; Beamforming	Week 3
Multiple Access; OFDMA; SC-FDMA	Week 4
Cellular Technologies; Traffic Engineering; Capacity Planning	Week 5
4G; LTE; LTE-A; Cognitive Radio	Week 6
5G	Week 7
Low-Power Wide-Area Networks + Midterm exam	Week 8
Sensor Networks; IoT communications; D2D; M2M	Week 9
Vehicular Networks	Week 10
Wireless LAN; Ad hoc Networks; Routing Protocols	Week 11
Personal-Area Networks; Body-Area Networks	Week 12
Security Challenges in Wireless Networks	Week 13
Recent advances in wireless and mobile networks	Week 14
Review and evaluation, presentations, and project demos	Week 15
Final Exam	Week 16