1. **Course number and name**
   EE 432: RF Engineering for Telecommunications

2. **Credits and contact hours**
   4.0 (three lecture hours and three laboratory hours per week)

3. **Instructor's or course coordinator's name**
   Ben Belzer

4. **Text book, title, author, and year**
   Online text chapters by Prof. Scott Hudson, WSU Tri-Cities
   Other supplemental materials
   Optional Textbooks:
   T. S. Rappaport. 2002. *Wireless Communications: Principles and Practice* (2nd ed.). Prentice-Hall PTR. ISBN 0-13-042232-0.
   Online lecture notes and lab assignments.
   Selected readings posted online.

5. **Specific course information**

a. *Catalog description:* System and radio propagation issues for wireless telecommunications. Cellular, PCS, microwave, and satellite system analysis, design, measurement and testing.

b. *Prerequisites or co-requisites:* EE 341 with a C or better; EE 351 with a C or better; Math 360 or Math 443 with a C or better.

6. **Specific goals for the course**
   At the end of this course, students must be able to:
   - Apply the theory of radio wave propagation in free space and terrestrial environments to RF engineering problems; conduct and analyze propagation experiments. (1a-e, 6a-c, 7a,b,d,f,g)
   - Apply probabilistic models of RF propagation and reception, including link budgets, multipath fading, motion effects, and diversity reception; conduct and analyze experiments involving multipath fading (1a-e, 6a-c, 7a,b,d,f,g)
   - Apply cellular systems concepts to RF engineering problems, including SNR and SIR computations, frequency reuse, and introductory queuing theory. (1a-e, 6a-c, 7a,b,d,f,g)
   - Understand health issues for wireless communications. (1a-e, 2a,c,e-g, 4a,d, 7a,b,d,f,g)
   - Apply the theory of digital modulation/demodulation to RF engineering problems, including non-coherent FSK transmitter and receiver design. (1a-e, 2a,c,e,g, 6a-c, 7a,b,d,f,g)
   - Apply channel coding concepts to RF engineering problems, including channel capacity computations and construction and analysis of simple block codes. (1a-e, 6a-c, 7a,b,d,f,g)

- Apply the theory of orthogonal frequency division multiplexing (OFDM) to RF engineering problems; conduct simulations of OFDM communication systems. (1a-e, 2a,g, 6a-c, 7a,b,d,f,g)
- Work in teams of two or three to accomplish course laboratory objectives. (5b,d-f)
- Communicate theory, design, results and analysis through written lab reports. (3a-e)

7. Brief list of topics to be covered

- Radiowave propagation
- Empirical propagation models and link budgets
- Multipath and fading
- Diffraction and computer propagation tools
- Cellular concept, frequency reuse, and queuing theory
- Health issues for wireless
- Digital modulation/demodulation: FSK, BPSK, QPSK, QAM
- Spread spectrum and CDMA
- Channel capacity and channel coding
- OFDM, LTE and 4G; introduction to 5G