EE 5141 – Introduction to Cellular and Wireless Communications

July-Nov. 2014 **Contents** Slot: G Room # ESB-350

1. Why wireless? Analog versus Digital wireless communications; Wireless Technology Standards – Distributed versus Centralised resource management, LAN and Cellular Standards, evolution from 2G to 4G mobile cellular access (see Chap.2 in [2])

2. Multiple Access Principles – FDMA, TDMA, CDMA, and OFDM; CSMA-CA for adhoc wireless, (see Chap.4 from [1]); Cellular Concept – Why Spatial Reuse, Trunking Efficiency vs Spatial Reuse, (see Chap.3 and Appendix A in [2]). Figures of Merit (Signal to Interference plus Noise Ratio, Sum-rate, User capacity, Spectral Efficiency, Throughput, Goodput.

3. Quick look at 2G GSM standard, User capacity of TDMA cellular, SINR in TDMA, soft-capacity of 2G DS-CDMA; Also see Chap.4 from [1]. *Aside*: Review of functions of random variable(s). Interference limited behavior of universal reuse systems, role of antennas (sectoring, MIMO), quick look at 4G cellular OFDM standards (WiMax and LTE)

4. Wireless Link – path loss, short-term fading, shadow loss, receiver sensitivity (see Appendix B in [2]). Multipath propagation – fading, delay spread, angular spread; statistical modelling of multipath wireless channels (see Chap. 2 in [1], and also Chap.5 in [2]). *Aside*: Review of random processes, wide-sense stationary processes (WSS), auto-correlation, and power spectral density of WSS processes; link budget for noise-limited and interference-limited links, relay channels

5. Wireless (Cellular) Network Performance – How to study network-wide performance? Evaluation Methodology for System level simulation in WiMax and LTE; Using stochastic geometry for abstracting the wireless system; system simulation examples – MIMO OFDM Reuse-1 system

6. Capacity of wireless Channels (Chap. 5 in [1]), Multi-antenna communications – Modellig (Chap. 7 in [1]) and Algorithms (parts of Chap. 8 in [1]), impact of MIMO on link and system performance

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Text Book: [1] D. Tse and P. Vishwanath, "Fundamentals of Wireless Communication", Cambridge Press, 2005.

Reference Book: [2] T.S. Rappaport, "Wireless Communications – Principles and Practise", Pearson (2nd Ed.), 2002.

Evaluation scheme: Quizzes (30), Simulation and Regular Assignments (20), Miniproject (10), and EndSem (40).

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