**ECN-519: Wireless Communication Systems** **ECE Dept. IITR**

Assignment 6: Capacity of wireless channels (Part-2)

Date: October 7, 2021 Submit by: October 18, 2021

**Problem 1:** Capacity of SIMO channel i.e., $C = \mathbb{E}\{\log_2(1 + \|\mathbf{h}\|^2 \text{SNR})\}$, where $\mathbf{h} \sim \mathcal{CN}(0, 1) \in \mathbb{C}^{N_R \times 1}$. Assume $N_R = 5$ receive antennas.

**Problem 2:** Capacity of MIMO channel: $C = \mathbb{E}\left\{\log_2 \left|\mathbf{I}_{N_R} + \frac{\text{SNR}}{N_T}\mathbf{H}\mathbf{H}^H\right|\right\}$, where $\mathbf{H} \sim \mathcal{CN}(0, 1) \in \mathbb{C}^{N_R \times N_T}$. Assume $N_R = N_T = 5$ receive antennas.

**Problem 3:** Compare the capacity of SIMO and MIMO channel and write down your observations with proper reasoning.

Note: Vary the SNR from $-10$ dB to 40 dB in steps of 2 dB. Plot capacity versus SNR (dB), where SNR (dB) $= 10 \log_{10}(\text{SNR})$.