

1.	Title of the course	Multiple Antenna Communication for 5G and Beyond
2.	Course number	EE566L
3.	Structure of credits (L-T-P-C)	3-0-0-3
4.	New course/modification to	New
5.	To be offered by	Electrical Engineering
6.	Prerequisite	CoT
7.	Course Objective(s): To introduce the mathematical framework and techniques required to design and analyze multiple antenna communication systems and the next-generation wireless communication systems.	
8.	Course Content: Introduction: evolution of wireless communication standards, review of complex Gaussian random variables and wireless communication; Multiple antenna communication: SISO, MISO, SIMO systems, introduction to MIMO and multiuser MIMO systems, diversity and spatial multiplexing techniques, capacity and capacity bounding techniques; Massive MIMO: precoding and combining techniques, zero forcing, maximal ratio, minimum mean square error precoder and combiner; Power control in massive MIMO: sum rate and minimum rate maximization, energy efficiency, correlated Rayleigh fading; Introduction to cell-free massive MIMO and intelligent reflecting surfaces.	
9.	Textbook(s): 1. Marzetta T L, Larsson E G, Yang H and Ngo H Q, Fundamentals of Massive MIMO, Cambridge University Press (2016). 2. Tse D and Viswanath P, Fundamentals of Wireless Communication, Cambridge University Press (2005).	
10.	Reference(s): 1. Björnson E, Hoydis J and Sanguinetti L, Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency, now (2017). 2. Demir Ö T, Björnson E, and Sanguinetti L, Foundations of User-Centric Cell-Free Massive MIMO, now (2021).	