Course Overview

- Duration: 5h 33m
- Sections: 7
- Lectures: 115
- Instructor: Dr. Moazzam Tiwana
- Platform: Udemy

Section 1: Introduction

- Main Components of 5G Network Architecture
- Next Generation NodeB (gNB)
- PDU Sessions
- 5G Use Cases (eMBB, URLLC, mMTC)
- 5G NR Frequency Bands
- Popular 5G Bands

Section 2: 5G Radio Access Technology (RAT)

- Basics of OFDM
- OFDM in Practice
- Multipath & Cyclic Prefix
- Flexible Numerology & Frame Structure
- Resource Block (RB) & Resource Element (RE)
- FDD/TDD Modes - SUL & SDL
- Slot Formats & Indicators
- Self-contained Slots & Mini-Slots
- Modulation & Coding Schemes (MCS)
- Numerology vs Cell Size
- TDD Deployment Advantages
- FR1 vs FR2 Bands

Section 3: Massive MIMO & Beamforming

- Introduction to MIMO & Beamforming
- Transmission Chain
- Analog, Digital, Hybrid Beamforming
- Active Antenna System (AAS)
- 8T8R & 64T64R Configurations
- Antenna Sizes (Sub-6GHz vs mmWave)
- Virtualized Antennas & AAU
- RF Planning Scenarios
- Grid of Beams (GoB)
- Antenna Port vs Physical Antenna
- DL/UL MIMO Characteristics
- Channel State Information (CSI)
- CSI Types & Reports
- Co-phasing & Subtypes
- Flow Diagrams for DL SU-MIMO

Section 4: 5G NR Protocol Stack

- Control/User Plane Separation
- Control Plane Stack
- User Plane Stack
- Combined Stack
- NAS Layer
- RRC Layer
- SDAP Layer
- PDCP Layer
- RLC Layer (TM, AM, UM)
- MAC Layer

Section 5: gNB Split Options

- CU/DU Disaggregation
- Functional Split Options (1, 2, 6, 7.2x, 8)
- Logical View of RAN Splits
- Enhanced CPRI (eCPRI)

Section 6: RAN Deployment Options

- Dual Connectivity (DC)
- NSA Options (3, 3a, 3x, 4, 7)
- SA Options (1, 2)
- Data Bearer Stack
- Unlikely Options (5, 6)

Section 7: 5G NR Air Interface

- Channel Bandwidth & NR-ARFCN
- Bandwidth Part (BWP)
- Resource Grid
- Logical, Transport, Physical Channels
- Reference Signals: DM-RS, CSI-RS, SRS, PT-RS
- Cell Acquisition: SSB, PCI, MIB, SIB1
- Initial Access (RACH)
- Scheduled Data Transmission
- Paging Process