Training Course on RF and Microwave Circuit Design for 5G/6G

Professional Development Training Course Outline

Category	Engineering	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Introduction

The RF and Microwave Circuit Design for 5G/6G Training Course offers cutting-edge knowledge and practical experience in designing next-generation wireless communication systems. As the demand for high-frequency, high-speed, and high-bandwidth communication accelerates with the rise of 5G and 6G technologies, engineers must be equipped with the skills to create RF and microwave circuits that meet stringent requirements for low latency, high data rates, and energy efficiency. Training Course on RF and Microwave Circuit Design for 5G/6Gprovides hands-on training in the design, simulation, and validation of RF front-end modules, power amplifiers, mixers, filters, oscillators, and antennas using industry-standard tools such as Keysight ADS, HFSS, and MATLAB RF Toolbox.

Participants will dive deep into advanced topics such as millimeter-wave circuit design, beamforming, antenna array integration, EM simulation, and nonlinear device modeling. Real-world case studies from 5G base stations, mmWave handsets, automotive radar, and satellite IoT systems are integrated throughout the course. Whether you're an experienced RF engineer or a new graduate entering the telecommunications industry, this training prepares you to design, test, and optimize RF components for the next wave of ultra-fast, ultra-reliable wireless networks.

Programme Curriculum

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Course Objectives

1. Understand RF and microwave fundamentals for 5G/6G networks.
2. Design and simulate RF front-end circuits using ADS and HFSS.
3. Implement millimeter-wave (mmWave) components for high-frequency applications.
4. Analyze signal propagation, S-parameters, and impedance matching.
5. Design efficient power amplifiers with linearization techniques.
6. Integrate high-gain antenna arrays and beamforming networks.
7. Model and simulate mixers, filters, and oscillators for RF chains.
8. Optimize circuits for low noise figure and high linearity.
9. Address challenges in PCB layout for RF and mmWave systems.
10. Perform EM simulations using full-wave solvers.
11. Design circuits for RF energy harvesting and IoT applications.
12. Validate hardware performance with real-world case studies.
13. Prepare for 6G evolution with THz and AI-integrated circuits.

Organizational Benefits

1. Future-proof your team with 5G/6G-ready RF design skills.
2. Accelerate time-to-market for wireless and IoT products.
3. Reduce design errors with advanced simulation and modeling.
4. Improve system performance through optimized RF circuits.
5. Enhance innovation in telecom, radar, and satellite domains.
6. Build in-house expertise in cutting-edge RF technologies.
7. Reduce dependency on external design consultants.
8. Improve product efficiency, bandwidth, and coverage.
9. Ensure regulatory compliance and EMI/EMC readiness.
10. Position your organization as a leader in next-gen wireless systems.

Target Participants

- RF and Microwave Engineers
- Telecommunications Engineers
- Embedded System Designers

- Wireless Hardware Developers
- Antenna Designers and Systems Engineers
- IoT and Satellite Communication Teams

Course Outline

Module 1: Introduction to RF and Microwave Engineering

- Frequency spectrum and applications
- Key parameters: gain, noise, linearity
- RF front-end overview
- Differences between 5G and 6G requirements
- Case Study: RF system in 5G smartphones

Module 2: Transmission Lines and S-Parameters

- Coaxial, microstrip, and CPW lines
- Reflection and return loss
- Smith chart analysis
- Impedance matching networks
- Case Study: PCB trace design for GHz frequencies

Module 3: High-Frequency PCB Design for RF Circuits

- PCB materials and stackups
- Parasitics and signal integrity
- Grounding and shielding techniques
- RF connectors and transitions
- Case Study: mmWave module PCB layout

Module 4: RF Simulation and Modeling Tools

- ADS and Microwave Office overview
- Circuit simulation and tuning
- EM modeling with HFSS
- Parameter sweeps and optimization
- Case Study: Simulating a 3.5 GHz LNA

Module 5: Amplifier Design and Linearity

- LNA and HPA topologies
- Power gain and efficiency
- Biasing techniques
- Stability and matching
- Case Study: 28 GHz PA design

Module 6: Mixer and Frequency Converter Design

- Types of mixers: passive and active

- Conversion loss and isolation
- LO drive requirements
- Image rejection techniques
- Case Study: Mixer in 5G RFIC

Module 7: RF Filters and Duplexers

- BPF, LPF, HPF design techniques
- Filter response and pole placement
- Duplexer structure and requirements
- Miniaturization strategies
- Case Study: 3 GHz SAW filter design

Module 8: Oscillators and PLLs

- Phase noise and frequency stability
- VCO design and analysis
- Loop filter design
- Frequency synthesizers
- Case Study: PLL in 5G transceiver

Module 9: Antenna Design and Beamforming

- Patch, dipole, and array antennas
- Gain, radiation pattern, bandwidth
- Beamforming techniques
- Array calibration and phasing
- Case Study: 64-element beamforming array

Module 10: mmWave and 6G Circuit Design

- mmWave challenges and techniques
- Component packaging and interconnects
- Thermal and mechanical concerns
- Sub-THz circuit design concepts
- Case Study: 77 GHz radar module

Module 11: Nonlinear RF Behavior and Harmonics

- Intermodulation and spurious responses
- IP3 and P1dB measurements
- Envelope simulation
- Distortion and linearization
- Case Study: Doherty PA nonlinearity mitigation

Module 12: RF Energy Harvesting and Low-Power Design

- Rectenna design
- Impedance matching for energy harvesting

- Power management and conversion
- Applications in IoT and sensors
- Case Study: RF-powered temperature sensor

Module 13: EM Simulation for RF Circuits

- 3D modeling and meshing
- Field solvers and convergence
- Coupling and radiation analysis
- Validation with hardware
- Case Study: Antenna EM simulation

Module 14: Thermal and Reliability Analysis

- Power dissipation in RF devices
- Heat sink and via strategies
- Reliability over temperature cycles
- Aging models for semiconductors
- Case Study: PA reliability in outdoor base stations

Module 15: RF Testing and Measurement

- Network analyzers and spectrum analyzers
- Noise figure, SNR, gain, and VSWR
- Over-the-air (OTA) measurements
- Calibration and de-embedding
- Case Study: Lab testing of 5G module

Training Methodology

This course employs a participatory and hands-on approach to ensure practical learning, including:

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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