Syllabus

Hands-on Introduction to Software Defined Radio using GNU Radio

Software Defined Radio Solutions, LLC, March 18, 2026

We are an approved provider of IEEE CEU/PDH certificates.

Overview

This course is designed to help technical professionals progress from being novices with basic awareness of and no or minimal experience with software defined radio (SDR), who may see SDR as very complex and potentially frustrating, to confident SDR application developers who are familiar with SDR concepts, enabling technologies, and applications, and prepared to continue SDR-related learning as needed. Participants will have up to five weeks to complete a self-selected Capstone project and those who complete all course activities will receive a Certificate of Completion. There will be opportunities to make up any missed sessions asynchronously. In the beta-testing phase, some adaptations to the syllabus can be made to meet specific needs of participants.

Learning Objectives

Participants who complete the program will be able to:

1. Provide a working definition of SDR
2. Enumerate, and briefly describe important considerations related to, major enabling technologies and applications of SDR
3. Use selected SDR application development tools and hardware at an intermediate level
4. Collaborate on SDR application development & testing projects
5. Apply and extend their newly gained knowledge through a self-selected individual or team capstone project
6. Harness AI engines to amplify their new knowledge and skills, pre-existing in-depth knowledge, and creativity to develop SDR signal processing, source, and/or sink blocks, and/or develop SDR application flow graphs.
7. Continue learning SDR-related topics and tools as needed for their purposes.

Testimonials from Students:

- "practical skills that I can transfer directly to my workplace."
- "directly relevant to my job."
- "hands-on experience was extremely helpful, especially when dealing with new hardware."
- "The labs are particularly helpful, as well as the professor's knowledge of using GRC [GNU Radio Companion SDR application development tool]."
- "[Allowed] us to really open up the realm of possibilities in SDR development."
- "the focused instruction showed me what to look for next to branch out and learn more"

US-based? Email sdrsolutionsco+sdrshortcourse@gmail.com to discuss the course and lock in $1,850 in savings: $1,000 discount, $850-value assembled, tested, ready-to-use development kit are included in the $2,450 beta-tester price

- Learn by working through interactive examples and labs with instructor support.
- As a beta tester, help us tailor the course to needs of working professionals.
- Get customized feedback to develop your expertise.
- ***Instructor has 25+ years' SDR-related education & application experience.***

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Course Outline:

Week 1:

- ***Meeting 1: Lecture/Example/Exercise Session (90 minutes):***
  - Introductions
  - Course overview including policies, learning objectives, course structure and content, surveys, and opportunities to provide informal feedback
  - Brief start-of-course survey
  - Wireless communications & SDR overview; Additional background resources
  - SDR hardware and software and example products and toolkits
  - Hardware/software SDR Development Kit review
  - GNU Radio (GR) Companion (GRC) SDR application development tool walk-through
  - Work-along example: FM receiver with SDR hardware and GUI
  - Exercise: Customize GUI layout
  - Exercise: Add Dual-band/dual-mode capability to FM receiver (finish between sessions if needed)
  - Session recap and preview of the following week
  - Assignment: Watch brief video that demonstrates FM capture effect using a GR simulation
- ***Meeting 2: Consulting/Help Session (90 minutes)***
  - Beta Tester Feedback; Exercise follow-up & demos; Introduction to community discussion platform; Q&A/Discussion; Start-of-course survey follow-up; Brief summary of next session's topics

Week 2:

- ***Meeting 1: Lecture/Example/Exercise Session (90 minutes):***
  - RF front end subsystems, components, effects, and metrics; Examples of multiple metric definitions
  - GR Throttle block
  - Work-along example: Ready-to-run nonlinear effect and I/Q imbalance simulator, showing effects on digital (QAM), & analog (AM & FM) signals
  - Direct digital signal synthesis
  - Analog-to-digital and digital-to-analog converters, limitations, and specifications
  - Common digital signal processing operations
  - Sample rate conversion
  - OFDM overview and demonstration
  - Work-along example: AM/FM signal demodulation with sample rate and quantizer resolution effects
  - GR Virtual Sinks and Sources; Hier blocks, Pad sink/source, additional blocks that enable run-time monitoring and control of a flow graph
  - Exercise: Build and enhance a multi-band FM scanner flow graph using a Python module (finish between sessions if needed)
  - Session recap and preview of the following week

- ***Meeting 2: Consulting/Help Session (90 minutes)***
  - Beta Tester Feedback; Exercise/Community Discussion follow-up & demos; Q&A/Discussion; Brief summary of next session's topics

Week 3:

- ***Meeting 1: Lecture/Example/Exercise Session (90 minutes):***
  - GR Python block
  - Work-along Exercise: Use AI to design a simple GR block
  - Antennas, Radio-Wave Propagation, Diversity Combining
  - Using Pluto Plus SDR
  - Demonstration: Diversity Combining FM Receiver flow graph
  - Building a test harness
  - Form teams and start team project to develop diversity combiners & simulation test harness to compare techniques (Optional to use AI)
  - Session recap and preview of the following week
- ***Meeting 2: Consulting/Help Session (90 minutes)***
  - Beta Tester Feedback; Exercise/Community Discussion follow-up & demos; Q&A/Discussion; Brief summary of next session's topics

Week 4:

- ***Meeting 1: Lecture/Example/Exercise Session (90 minutes):***
  - Mid-course survey
  - Team project follow up
  - Exercise: Diversity-enabled FM receiver/scanner on Pluto Plus and/or RTL-SDRs
  - Capstone Project topic selection (and team formation as needed).
  - Session recap and preview of the following week
- ***Meeting 2: Consulting/Help Session (90 minutes)***
  - Beta Tester Feedback; Exercise/Capstone/Community Discussion follow-up & demos; Q&A/Discussion; Mid-course Survey follow-up; Brief summary of next session's topics

Week 5:

- ***Meeting 1: Lecture/Example/Exercise Session (90 minutes):***
  - Capstone Project updates
  - Phased Arrays and Beamforming
  - Work-along Example: Beamforming receiver/scanner on Pluto Plus
  - Exercise: Select and implement an enhancement to the Beamforming SDR receiver (e.g., dual-band or scanning capability, GUI enhancement, GUI simplification/downsizing for portable use)
  - Session recap and preview of the following week
- ***Meeting 2: Consulting/Help Session (90 minutes)***
  - Beta Tester Feedback; Exercise/Capstone Project follow-up & demos; Q&A/Discussion; Brief summary of next session's topics

Week 6:

- ***Meeting 1: Lecture/Example/Exercise Session (90 minutes):***
  - Capstone Project updates
  - Advanced GNU Radio topics
  - Examples of other SDR software and hardware
  - Case study: Review of SDR hardware data sheet or data sheets
  - End-of-course survey
  - Session recap and preview of the following week
- ***Meeting 2: Consulting/Help Session (90 minutes)***
  - Beta Tester Feedback; Exercise/Capstone Project follow-up & demos; Q&A/Discussion; End-of-course survey follow up; Preview of Bonus Session 1

Bonus Session 1 (90 minutes):

- Capstone Project follow up
- SDR product and system invention, experimentation, and testing resources
- Setting up an SDR lab, including low-cost and portable options
- Examples of SDR implementations of wireless standards
- End-of-course survey follow up
- Resources for learning more and continued mentoring/consulting options
- Q&A/Discussion
- Preview of Bonus Session 2

Bonus Session 2 (90 minutes):

- Capstone Project follow up
- Examples of SDR-related projects done by instructor and co-instructor
- Presentation on selected SDR-related project
- End-of-course survey follow up
- Resources for learning more and continued mentoring options, continued
- Bonus Session survey
- How to request course completion certificate
- Q&A/Discussion