

General License and EMS Course Overview

This advanced course builds upon the knowledge gained in the technician course. Over twelve weeks of instruction, you will delve deeper into concepts such as impedance and inductors. Additionally, you will explore new topics including sunspots, solar radiation, and ionospheric disturbances. Practical hands-on experience is part of the course, involving activities like operating a ham radio and using a web-based software-defined radio (SDR). Optional activities such as constructing a crystal radio, creating an antenna from everyday items like a can of ham, and learning soldering techniques are also available. Each lesson's specific learning objectives can be accessed by clicking on the lesson title in the provided table. By the course's conclusion, you will be well-prepared to take the General License Exam.

Approximate time to complete the course: 37.5 hours.

LESSON 1: UPGRADING TO THE GENERAL CLASS

Unlock new opportunities in amateur radio by upgrading from your Technician Class license to a General Class license. This introductory lesson will explore the enhanced privileges and capabilities that come with a General Class license, such as expanded access to HF bands and the ability to operate in phone and digital modes. You'll delve into the structure and content of the General Class exam, receive practical advice on where and how to take the test, and gain insights into effective study strategies. Beyond the test, we'll highlight the importance of continuous learning, hands-on practice, and community involvement in enriching your amateur radio experience. Join us to elevate your skills, broaden your horizons, and become a more versatile and knowledgeable radio operator.

Learning Objectives:

By the end of this lesson the learner will know or be able to:

1. Explain the expanded privileges granted to General Class license holders.
2. Identify key reasons to upgrade from a Technician Class license to a General Class license.
3. Outline the requirements and study materials needed for the General Class exam.
4. Develop a study plan to prepare for the General Class license exam.
5. Locate and schedule an exam session for the General Class license.
6. Access additional resources to enhance your understanding of amateur radio.
7. Prepare for the AARL General License Exam.

Approximate time to complete the lesson: 3 hours.

LESSON 2: ELECTRICAL PRINCIPLES

Welcome to lesson two Electrical Principles. This lesson covers electrical principles, including reactance, impedance, impedance matching, and basic calculations for capacitive and inductive reactance. It explores how resistors, capacitors, and inductors behave in series and parallel configurations and introduces transformers and mutual inductance. The content also discusses the use of transformers for impedance transformation and the importance of understanding unit conversions when working with capacitors. Finally, it touches on the concept of transformers acting as both step-up and step-down transformers and the implications of using transformers for unintended purposes. The lesson will also include sample questions from the exam that cover ham-related electrical principles.

Learning Objectives:

By the end of this lesson the learner will know or be able to:

1. Understand the fundamental principles of reactance, impedance, and impedance matching.
2. Analyze the behavior of resistors, capacitors, and inductors in series and parallel circuits.
3. Explain the function and applications of transformers and mutual inductance.
4. Practice taking “Electronic Principles” portion of the Ham General License Exam with actual questions from the current exam.

Approximate time to complete the lesson: 3.5 hours.

LESSON 3: CIRCUIT COMPONENTS

This course provides a comprehensive overview of essential circuit components crucial for the ARRL General License exam. Students will explore the practical considerations and applications of resistors, capacitors, inductors, diodes, transistors, vacuum tubes, batteries, integrated circuits, display devices, and connectors. Emphasis will be placed on understanding the characteristics, advantages, and limitations of each component, as well as their roles in various amateur radio circuits. By the end of the course, students will have a solid foundation in circuit components, preparing them for both the exam and practical applications in amateur radio operations.

Learning Objectives:

By the end of the lesson the learner will know or be able to:

1. Understand the practical considerations and applications of resistors, capacitors, and inductors in circuits.
2. Explain the functions and specifications of diodes and transistors in electronic circuits.

3. Describe the operation and characteristics of vacuum tubes used in amateur radio equipment.
4. Identify the types and features of batteries commonly used in amateur radio operations.
5. Differentiate between various types of integrated circuits, including analog, digital, and microwave ICs.
6. Recognize the functions and uses of display devices and connectors in amateur radio systems.
7. Prepare for the exam.

Approximate time to complete the lesson: 2.5 hours.

LESSON 4: PRACTICAL CIRCUITS

This module provides an in-depth exploration of practical circuits essential for amateur radio operation, covering modes and bandwidth, filter types, oscillators, mixers, multipliers, modulators, transmitter and amplifier fundamentals, receiver fundamentals, and installing an HF station. Participants will build upon their knowledge of electronics fundamentals and components to understand the inner workings of real radios, including transmitters, receivers, and amplifiers. Through detailed analysis and hands-on activities, students will gain insights into circuit design, adjustment procedures, and equipment structure, preparing them for practical applications in amateur radio operation.

Learning Objectives:

By the end of the lesson will know or be able to:

1. Explain the different modes of transmission used in amateur radio communication and their corresponding bandwidth requirements to select appropriate operating modes for specific communication purposes.
2. Identify the characteristics and applications of various filter types, including low-pass, high-pass, band-pass, and band-stop filters, to enhance signal quality and suppress unwanted interference in RF circuits.
3. Describe the principles and operation of oscillators used in radio equipment, including crystal oscillators and voltage-controlled oscillators, to generate stable RF signals for transmission and local oscillation.
4. Analyze the function and performance of mixers, multipliers, and modulators in radio frequency (RF) circuits, including frequency conversion, signal multiplication, and modulation techniques, to understand signal processing and modulation principles.
5. Understand the fundamentals of transmitter and amplifier circuits, including power amplification, modulation, and signal amplification, to design and operate efficient and effective transmitter and amplifier systems in amateur radio applications.
6. Prepare for the General License examination.

Approximate time to complete the lesson: 2 hours.

LESSON 5: SIGNALS AND EMISSIONS

This lesson focuses on the fundamentals of signal propagation and the natural phenomena that affect it, crucial for effective amateur radio communication. Building on previous knowledge of electronics, signals, transmitters, receivers, and antennas, participants will explore how radio waves travel from point A to point B. Key topics include the structure of the ionosphere, reflection and absorption of signals, sky-wave and ground-wave propagation, sunspots and their cycles, assessing propagation conditions, solar phenomena, and scatter propagation. Understanding these concepts will enable students to predict and utilize propagation conditions for optimal communication on the HF bands.

Learning Objectives:

By the end of this lesson the learner will know or be able to:

1. Explain the structure of the ionosphere and its role in the propagation of radio waves, including reflection and absorption processes.
2. Differentiate between sky-wave and ground-wave signals and their respective propagation characteristics.
3. Analyze the impact of sunspots and sunspot cycles on HF propagation and how solar phenomena influence radio communication.
4. Assess propagation conditions using various methods and tools to predict and optimize HF communication.
5. Describe scatter propagation and its significance in extending the range of radio communications under specific conditions.
6. Prepare for the exam.

Approximate time to complete the lesson: 3.5 hours.

LESSON 6: ANTENNAS AND FEED LINES

This module provides an in-depth understanding of antennas and feed lines, critical components of any amateur radio setup. Students will learn about various types of feed lines, their characteristic impedance, and the importance of matching impedance to minimize signal loss. The module covers standing wave ratio (SWR) calculations, measurements, and their effects on transmission efficiency. Additionally, students will explore different types of antennas, including dipole, vertical, directional, and specialized antennas, and their respective applications. Practical guidance on antenna installation and feed point matching will ensure students can optimize their stations for efficient communication.

Learning Objectives:

By the end of this lesson the learner will know or be able to:

1. Understand Feed Lines and Impedance: Describe the characteristics of feed lines, including impedance and attenuation, and explain how to achieve optimal impedance matching to ensure efficient signal transmission.
2. Calculate and Measure SWR: Demonstrate how to calculate and measure the standing wave ratio (SWR) and understand its effects on transmission efficiency and feed line performance.
3. Antenna Types and Applications: Identify and describe various types of antennas, such as dipole, vertical, and directional antennas, and explain their applications and advantages in different scenarios.
4. Practical Antenna Installation: Apply knowledge of feed point impedance and matching techniques to install and optimize antennas, ensuring minimal signal loss and maximum efficiency.
5. Specialized Antennas and Mobile Operation: Explore specialized antenna types, including multiband, portable, and mobile antennas, and understand their design considerations and use cases.
6. Prepare for the exam.

Approximate time to complete the lesson: 3.5 hours.

LESSON 7: RADIO WAVE PROPAGATION

In the "Radio Wave Propagation" module, students preparing This course delves into the fascinating world of radio wave propagation, focusing on the various natural phenomena and technical parameters that influence amateur radio communications in preparation for the Ham General License Exam. Students will explore the impact of sunspots, solar radiation, ionospheric disturbances, and geomagnetic storms on HF band propagation. Key concepts such as the solar flux index, Sudden Ionic Disturbances (SID), and the K-index and A-index will be covered to provide a comprehensive understanding of the factors affecting signal transmission. Additionally, students will learn to predict and optimize communication paths using Maximum Usable Frequency (MUF) and Lowest Usable Frequency (LUF) calculations. Practical insights into different propagation modes, including scatter propagation and Near Vertical Incidence Skywave (NVIS) propagation, will equip learners with the knowledge to enhance their amateur radio operations.

Learning Objectives:

By the end of this lesson the learner will know or be able to:

1. Understand the effects of sunspots and solar radiation on HF band propagation.
2. Describe the impact of ionospheric disturbances and geomagnetic storms on radio signals.
3. Calculate the Maximum Usable Frequency (MUF) and Lowest Usable Frequency (LUF) for effective communication.

4. Analyze the use of solar flux index, K-index, and A-index in predicting radio wave propagation.
5. Explore different propagation phenomena, such as scatter propagation and NVIS.
6. Prepare for the exam.

Approximate time to complete the lesson: 3.5 hours.

LESSON 8: RADIO WAVE PROPAGATION

This course is designed to prepare students for the Ham General license exam by providing a comprehensive understanding of key concepts in station configuration, operation, test equipment, interference management, and mobile/portable operations. The course will cover the functionality and operation of modern HF transceivers, the purpose and use of various filters and attenuators, noise reduction techniques, CW operation, dual-VFO functionality, and digital modes. Additionally, students will learn about test equipment like multimeters and oscilloscopes, techniques for managing interference and grounding, and the importance of proper antenna tuning. Practical aspects of mobile and alternative energy source operations will also be explored.

Learning Objectives:

By the end of the lesson the learner will know or be able to:

1. Describe the configuration and operation of HF transceivers, including the importance of speech processors and S meters.
2. Identify and use essential test equipment, such as spectrum analyzers, oscilloscopes, and frequency counters, in ham radio operations.
3. Explain techniques for managing RF interference, proper grounding, and bonding in amateur radio setups.
4. Demonstrate the use of various modulation modes and identify the impact of phase noise and noise blankers on signal quality.
5. Explain how to set up mobile and portable HF stations, incorporating alternative power sources and addressing installation challenges.
6. Prepare for the exam.

Approximate time to complete the lesson: 3.5 hours.

LESSON 9: PRACTICAL APPLICATIONS

This comprehensive lesson on "Operating Procedures" prepares students for the ARRL Ham General License Exam. The curriculum is designed to impart in-depth knowledge and practical skills necessary for effective and responsible amateur radio communication. Covering essential

aspects such as phone and CW operating procedures, emergency operations, digital modes, and the Volunteer Monitoring Program, the course emphasizes adherence to protocols, efficient use of equipment, and courteous interaction with the amateur radio community. By understanding these fundamental operating procedures, students will be well-prepared to pass the exam and excel in their amateur radio endeavors.

Learning Objectives:

By the end of the lesson the learner will know or be able to:

1. Understand and Apply Phone Operating Procedures.
2. Operate Effectively on the HF Bands.
3. Implement CW Operating Procedures
4. Participate in the Volunteer Monitoring Program and HF Operations.
5. Operate Digital Modes.
6. Prepare for the exam.

Approximate time to complete the lesson: 3.5 hours.

LESSON 9: PRACTICAL APPLICATIONS

This comprehensive lesson on "Operating Procedures" prepares students for the ARRL Ham General License Exam. The curriculum is designed to impart in-depth knowledge and practical skills necessary for effective and responsible amateur radio communication. Covering essential aspects such as phone and CW operating procedures, emergency operations, digital modes, and the Volunteer Monitoring Program, the course emphasizes adherence to protocols, efficient use of equipment, and courteous interaction with the amateur radio community. By understanding these fundamental operating procedures, students will be well-prepared to pass the exam and excel in their amateur radio endeavors.

Learning Objectives:

By the end of the lesson the learner will know or be able to:

1. Understand and Apply Phone Operating Procedures.
2. Explain how to Operate Effectively on the HF Bands.
3. Implement CW Operating Procedures
4. Participate in the Volunteer Monitoring Program and HF Operations.
5. Operate Digital Modes.
6. Prepare for the exam.

Approximate time to complete the lesson: 4 hours.

LESSON 10: ELECTRICITY AND RF SAFETY

We designed the lesson “Electricity and RF Safety” to equip you with the knowledge of electrical and RF safety essential for passing the ARRL General License Test. Just like observing good safety practices around your ham station and antenna system is crucial in the real world, this course will prepare you for the exam's emphasis on these topics. We will cover how to avoid electrical hazards from power lines and during equipment maintenance. You will also learn about proper grounding for electrical safety, stray RF suppression, and lightning protection. Finally, the course will address RF safety regulations set by the FCC and how to perform station evaluations to ensure compliance.

Learning Objectives:

By the end of the lesson the learner will know or be able to:

1. Understand and mitigate electrical hazards associated with power lines and equipment.
2. Implement proper grounding techniques for safety and RF suppression.
3. Apply best practices for safe antenna tower installation and lightning protection.
4. Explain FCC's RF exposure regulations and perform basic station evaluations.
5. Recognize safety considerations for emergency power sources.
6. Prepare for the AARRL General License Exam.

Approximate time to complete the lesson: 4.5 hours.

LESSON 11: COMMISSION'S RULES

In this lesson, students will learn about the Federal Communications Commission (FCC) rules and regulations essential for passing the ARRL General License Exam. The lesson will cover a wide range of topics, including General Class operator frequency privileges, antenna restrictions, beacon operations, one-way transmissions, international communication, encryption rules, transmitter power regulations, data emission standards, and 60-meter operation requirements. Additionally, the role of Volunteer Examiners, temporary identification, element credit, and remote operation will be explored. Students will also gain an understanding of control categories, repeater regulations, third-party communication rules, ITU regions, and automatic digital station controls. By mastering these topics, students will be well-prepared to operate within FCC guidelines and enhance their proficiency in amateur radio operations.

Learning Objectives:

By the end of the lesson the learner will know or be able to:

1. Identify the frequency privileges and restrictions for General Class operators on various bands.

2. Understand and comply with antenna regulations, including the FCC's PRB-1 policy and HOA agreements.
3. Operate beacon stations and conduct permitted one-way transmissions according to FCC rules.
4. Adhere to transmitter power regulations and data emission standards for different bands.
5. Understand the roles and requirements of Volunteer Examiners and the process for regaining operating privileges.
6. Prepare for the AARL General License Exam.

Approximate time to complete the lesson: 3 hours.

LESSON 12: PREPARE FOR THE EXAM

This final lesson is designed to equip you with the necessary tools and strategies to successfully take and pass the Ham General License exam. You will receive comprehensive guidance on preparing for the exam, including effective study techniques and practice with real exam questions. This lesson will also walk you through the registration process, provide tips for the exam day, and outline what to do in case of success or failure. Additionally, you will learn about the opportunities and next steps following the exam, ensuring you are well-prepared and confident in advancing your amateur radio journey.

Learning Objectives:

By the end of the lesson the learner will know or be able to:

1. Develop an effective study plan tailored to the Ham General License exam.
2. Practice with real questions from the Ham General License exam pool.
3. Navigate the registration process for scheduling your exam.
4. Understand and follow the procedures for taking the exam.
5. Manage both success and failure, with clear steps for retaking the exam if necessary.
6. Identify the next steps and opportunities available after passing the exam to further your amateur radio experience.

Approximate time to complete the lesson: 1 hour.