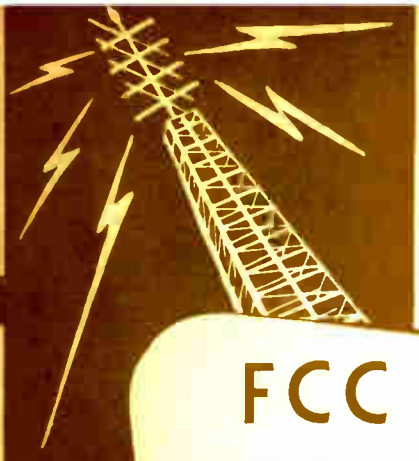
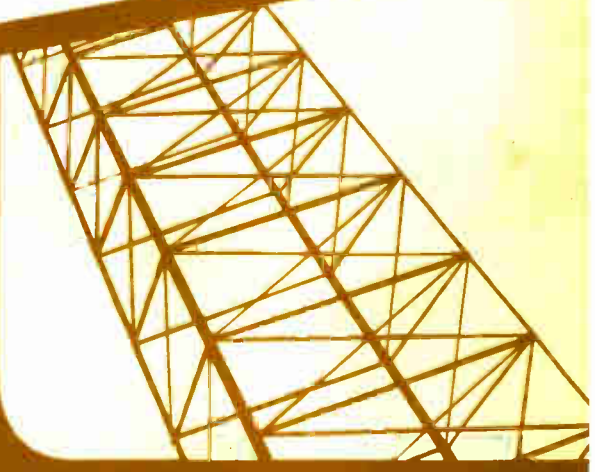


FCC QUESTIONS WITH ANSWERS

Element 2 - Part 2

Lesson ROE-5



DE FOREST'S RADIO TELEVISION ELECTRONICS TRAINING, INC.

DE FOREST'S TRAINING, INC.

2533 N. Ashland Ave., Chicago 14, Illinois

Lesson ROE-5

FCC Questions with Answers

Element 2 - Part 2

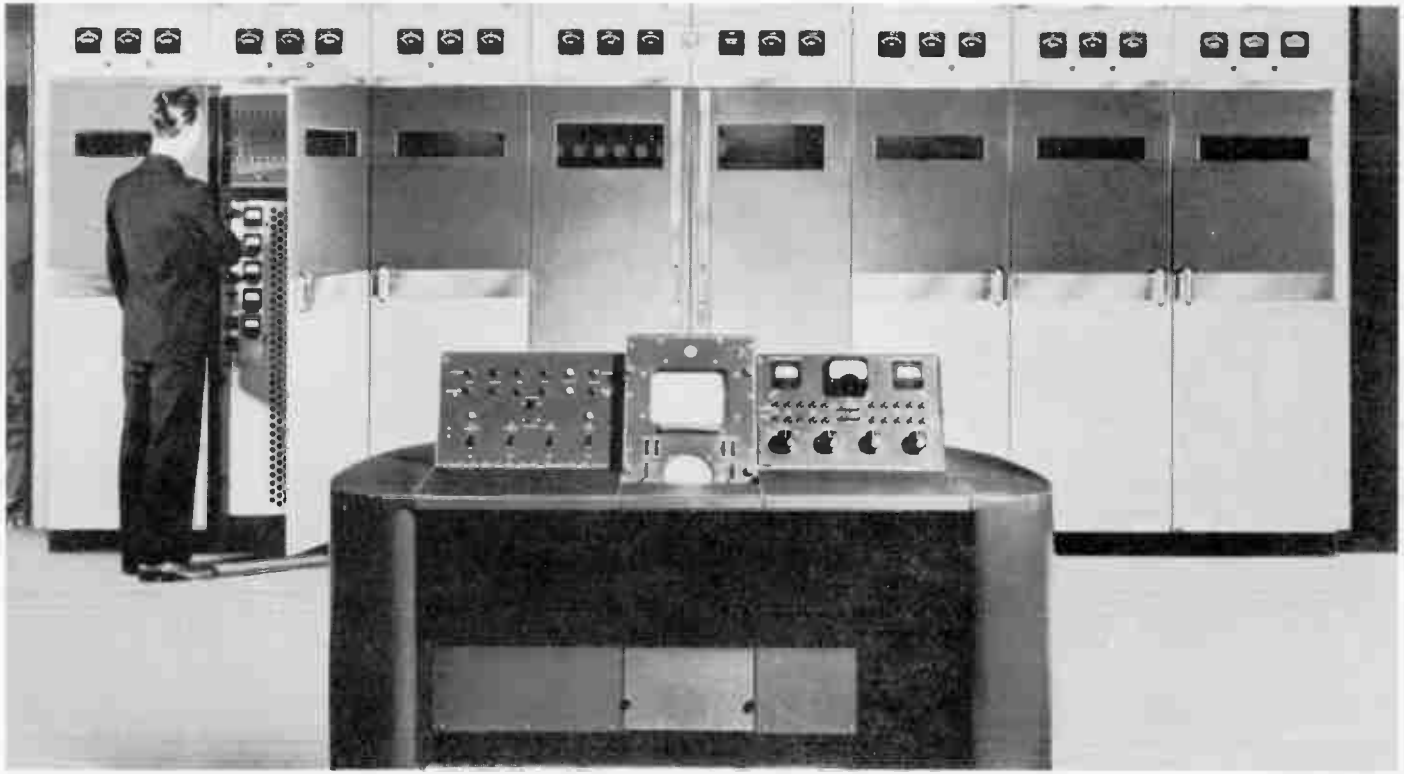
INDEX

"Each succeeding day is the scholar of that which went before it."

—Publius Syrus

DE FOREST'S TRAINING, INC.

2533 N. ASHLAND AVE., CHICAGO 14, ILLINOIS



Transmitting equipment of Station WFIL-TV. The transmitter bays are at the rear, the control console in the foreground.

Courtesy Station WFIL-TV, Philadelphia

FCC Questions with Answers
Element 2-Part 2

The following questions and answers complete Element 2:

2-31

In radiotelephone communications what would be a good choice of words to use if you wanted to request the operator at the other end of the circuit to speak more slowly?

"Speak slower please".

2-32

Can a radio operator always consider his radiotelephone conversations completely confidential and not heard by other persons?

No, radio signals normally travel outward from the transmitting station in all directions and can be intercepted by unauthorized persons.

2-33

What is the difference between "simplex" and "duplex" radiocommunication systems?

A "simplex" radio-communications systems is one in which the stations in communication with each other operate on the same frequency. In a "duplex" system, the stations in communication operate on different frequencies.

(In radiotelephone communications, the operators usually talk in a monologue. That is, one operator talks until he finishes and then turns the conversation over to the other. In some instances, the transmission of messages may be speeded up by employing break-in operation, a system OF OPERATION similar to that employed on land telephone lines where the person at one end may interrupt the person at the other end merely by speaking into the microphone.)

2-34

In calling a station by radiotelephony, how many times does the calling station generally repeat the sign or name of the called station in each calling transmission? How many times does the calling station repeat its own call sign or name in each calling transmission?

In making a call by radiotelephony, the call sign or name of the called station is generally given three times followed by the call letters or name of the calling station given three times.

(For example, if station KABC calls station WDEF, the call would be made as: WDEF WDEF WDEF FROM KABC KABC KABC OVER.)

2-35

Why should the operator wait several seconds after turning on a transmitter before pressing the push-to-talk button?

Generally when starting a radiotelephone transmitter the "on-off" switch should be turned on a few seconds before using the microphone in order that the tubes may reach proper operating temperature before going on the air.

(A good policy would be to turn on both the receiver and transmitter "on-off" switches at the same time. Then, after listening on the transmitter frequency long enough to determine that no interference will be caused with stations already in operation, transmission may be started by pressing the "push-to-talk button."

2-36

Why is it a good practice to remove a transmitter from the air while changing from one frequency to another?

A transmitter should be removed from the air while changing from one frequency to another so as to eliminate the possibility of causing interference with other stations.

2-37

If you are alone in a radio-equipped automobile why is it advisable to stop the car before using the radio equipment?

From a safety standpoint, it is generally best to stop the car before using the radio equipment when one is alone in a radio-equipped automobile. You may become so engrossed in the conversation that you will fail to see approaching danger until it is too late. Therefore, in the interest of your safety, as well as that of others, always pull off to the side of the road and stop before making a call or answering one.

2-38

Why is it advisable to keep the engine in an automobile running with the battery charging while using the radiotelephone for long periods in the car?

When communication traffic is heavy, the radio battery in a radio-equipped automobile may become discharged, therefore, when the radio is in constant use, it is advisable to keep the engine running with the battery on charge.

(As in the case of the regular car battery, it will be necessary to add water to the radio battery from time to time.)

2-39

If a given mobile radiotelephone station is powered by a storage battery what indication might an operator have that the battery needs recharging or other service?

Low signal strength or low voltage and current readings are some indications to an operator of a mobile station that the batteries need recharging or other service.

2-40

In receiving radio signals in an automobile, is reception usually better in the open country and on hilltops or in valleys and underpasses?

When operating a radiotelephone receiver in an automobile, communications are generally more satisfactory when the car is on a hilltop rather than in a valley. Communications usually are better from open spaces than from among trees, tall buildings or in underpasses.

2-41

If a radiotelephone operator desires to make a brief test of a transmitter what would be a good choice of words to use in the test?

In testing a radiotelephone transmitter the operator should clearly indicate that he is testing by repeating the word "testing" several times, and the station call sign or name of the station should be clearly given. Tests should be as brief as possible.

2-42

If radio communication is difficult, in an automobile parked at the wayside, what might the operator do to improve communication?

Sometimes there are dead spots for radio reception along streets and highways and the operator will find that moving to a new location will improve communications.

2-43

What is the purpose of the squelch control or switch on a radiotelephone communications receiver?

The squelch on a receiver is used to prevent static and noise from coming through the loud speaker at times when the receiver is in "stand-by" operation and no signal is being received.

(As a result of atmospheric disturbances and man-made static, most radio receivers have a comparatively high output noise level, especially when they are adjusted to receive distant stations. The noise may be very annoying, particularly when several receivers are operating simultaneously on different listening frequencies.

Known variously as interchannel noise suppressors, quieting, muting or squelch circuits, several arrangements for suppressing the noise have been developed. One common type of squelch circuit employs the received carrier to control the operation of one of the audio amplifier tubes. When the carrier is on, the amplifier tube operates normally but when the carrier goes off, the tube becomes inoperative so that no signal passes through it.

A disadvantage of the squelch circuit is that very weak signals cannot be heard while the circuit is in operation. Therefore, it has become standard practice to include a switch by means of which the squelch circuit may be made inoperative. In addition to the switch, a control may be provided to permit the operator to adjust the sensitivity of the squelch circuit to the existing noise level.)

2-44

When receiving weak signals on a radiotelephone communications receiver, should the squelch switch be placed in the "on" or "off" position? In what position should the switch be placed when receiving strong signals?

The squelch circuit has a tendency to reduce the sensitivity of the receiver and sometimes a weak signal can be received most effectively with the squelch off, in which case the receiving operator must tolerate static and noise in order to receive the signals. When receiving strong signals the squelch switch generally is placed in the "on" position.

2-45

During periods of severe static in what position should the squelch control be normally set?

On. See answer to Question 43.

2-46

If a radiotelephone communications receiver has an "electric-eye" to indicate correct tuning, how does the "eye" normally indicate the correct tuning when receiving a signal?

Usually by minimum shadow.

(An electric eye is a special type of vacuum tube that is designed to indicate visually, by means of a shadow on an illuminated fluorescent target, the effects of a controlling voltage that is applied to the tube. As used in a radio receiver, the tube is employed to indicate when the receiver is tuned exactly to the desired station. Special circuits in the receiver develop the controlling voltage and apply it to the indicator tube where it controls the amount of shadow produced on the target. Correct tuning generally is indicated by minimum shadow. The electric, or "Magic", eye normally is provided in tunable receivers, such as are used at land stations which operate on more than one frequency.)

2-47

What is the purpose of a fuse in a transmitter or receiver circuit?

Fuses are placed in electrical circuits to protect the equipment when electrical power faults occur. Fuses "burn out" or "blow out" when there are abnormally high currents, thereby protecting both the load and the source of power.

2-48

When replacing a fuse in a transmitter or receiver, why should the rating of the replacement be the same as that recommended by the manufacturer?

A burned out fuse should always be replaced with a fuse of a rating recommended in the operating instructions of the station. The manufacturer's recommended size is generally chosen to give maximum protection to the equipment with minimum interruptions to service resulting in optimum equipment performance.

2-49

If a 5-ampere fuse in a circuit "blows out" after a long period of normal operation, what size fuse would be appropriate for replacement?

5-ampere.

2-50

List two precautions that should be observed when replacing a tube in a receiver or transmitter.

When a tube is replaced in a radio receiver or transmitter, care must be observed that the replacement has the same type number as the tube removed or is recommended in the operating instructions of the equipment. It is always a good policy to turn off the receiver or transmitter completely when replacing tubes and fuses.

2-51

If smoke is observed emerging from a transmitter or receiver what should the operator do immediately?

If fire or smoke develops in a transmitter or receiver, the operator should immediately shut off the power.

If a fire extinguisher is used, it should be of a type designed for fighting electrical fires.

2-52

Why is it important that a fire extinguisher that is to be used for fighting fires in transmitters involving high voltages be of the type designed for fighting electrical fires?

Water and some types of extinguisher fluids may conduct electricity, and if used, may subject the operator to electrical shock.

2-53

Generally speaking, what is the approximate dependable working distance range of a transmitter working in an automobile?

In most cases the working distance range of a mobile transmitter in an automobile is approximately 5 to 35 miles depending on the type of terrain, proximity of buildings, trees, etc.

(Most of the special radio services that employ mobile transmitters in automobiles are assigned carrier frequencies in the

very-high frequency (VHF) band that extends from 30,000,000 to 300,000,000 cycles per second (30 to 300 megacycles). In the range of frequencies above about 30 megacycles, the radio waves have several characteristics that restrict the distance over which satisfactory radio communications may be carried on. At these frequencies, the radio waves act almost like light; they travel in nearly straight lines, are reflected and rapidly attenuated by buildings, trees, hills and other objects and seldom reach very far beyond the horizon. Another factor that restricts the distance over which satisfactory communication may be obtained is the limited power available from most automotive type mobile transmitters.

Thus, with buildings, trees and other objects attenuating the already small power, the working distance of most automotive type mobile transmitters is severely restricted.)

2-54

Why is it a good policy to make a daily test of a transmitter when it is in stand-by for long periods between transmissions?

If a radio station is used only for occasional calls, it is a good practice to test the station regularly. Regular tests may reveal defects or faults which, if corrected immediately, may prevent delays when communications are necessary.

2-55

Is it a good practice to make entries of station operation in a radio log prior to operating the station?

No, log entries pertaining to radio station operation should be made only as the operation of the radio station progresses and never in advance.

2-56

When does the radio day, that is the 24-hour period covered by a complete set of station records, of a station in continuous service, generally begin and end?

In domestic operations, the "radio-day", generally begins at midnight local standard time and ends at the following midnight. Station records generally are opened and closed each radio day.

2-57

In reference to electric shock, what is meant by artificial respiration and how is it administered?

By artificial respiration is meant that some mechanical means is employed to aid or start a person's regular breathing after it has stopped or become very weak.

It can be administered by a mechanical device or a person trained in its application.

The patient should be placed in a face down position with the head turned slightly to one side. Be sure the clothing is loosened and there is no obstruction to breathing in or around the mouth.

A slight pressure, *not to exceed 15 pounds,* should be applied with the palms of the hands just at the patient's lower or floating ribs, with a gentle forward motion, and then released at about the same rate as your own ordinary breathing.

Important: In order to be effective, at times artificial respiration must continue uninterrupted for 8 to 10 hours after a person has stopped breathing.

2-58

What should the operator at a radio station do immediately if he sees a person fall into contact with a high voltage circuit?

If a person is seen in contact with a high voltage circuit the operator should immediately shut off the power. If the victim is unconscious, artificial respiration should be administered immediately in accordance with first aid instructions and a doctor should be summoned.

2-59

During electric storms is it safe for a person to stand near high antennas or near antenna lead-ins?

During electrical storms it is unsafe for persons to be near high antennas or near antenna lead-ins. The probability of lightning discharges following these paths to ground is great and persons standing near these structures during electrical storms expose themselves to shock by electrical discharge.

The 10 examination questions at the end of this lesson are of the multiple choice type. Place the number of the selected answer in the space provided at the right of the question.

STUDENT NOTES

Radiosonde 1680 M.C.

STUDENT NOTES

Freq. [illegible]tion

410 K.C. Radio direction finding.
500 K.C. [illegible] freq. CW
1638 and 1708 K.C. [illegible] [illegible]tion [illegible]
2091 K.C. Ship [illegible] and [illegible] freq.
2105 to [illegible] [illegible] freq. [illegible] CW.
2182 [illegible] [illegible] [illegible]calling.

2638 }
2738 } inter ship [illegible]

2804 }
2808 } [illegible] [illegible] interzone
2812 } police.

2500 KC - WWV
328.6 to 335.4 Ground control approach

5 MC - WWV
10 MC - "
15 MC "
20 MC
25 MC
30 MC

915 MC
2450 MC
5850 MC
10,600 MC
18,000 MC
[illegible] industrial and scientific

Beacon freq. — a radionavigation system [illegible] automatically or in response to a predetermined signal. 3256 MC, 5450 MC, 9310 MC.

13,560 K.C. Industrial

121.5 M.C. aeronautical emergency freq.

T.V channels

LOW	HIGH
2 - 54 - 60	6 - 82 - 88
3 - 60 - 66	7 174 - 180
4 - 66 - 72	8 180 - 186
5 - 76 - 82	9 186 - 192

10 - 198
11 - 204
12 - 210
13 - 210

108.1 MC to 112 MC odd numbers are localizers even numbers are omni directional [illegible] range

FROM OUR *President's* NOTEBOOK

METHOD

I know a man who, but for the fact that he has never learned to organize himself, might today be leaning back in some comfortable spot below the frost belt with nothing to do but enjoy his dozen or more hobbies.

But he will probably never make it, for he lacks **Method.** He always has several irons in the fire at the same time. He's rarely half way through with one project before an idea pops into his head starting him on another.

Soon he has another and another and when the Deadline on "Project A" approaches he's obliged to work day and night to barely meet it and, as our launderess used to say—"he don't but jest".

He's never at ease for there's always a clock and a calendar staring him in the face, silently reminding him that he's about to be late in keeping this commitment or that one.

Years ago, by organizing himself on a "one-thing-at-a-time" basis—by learning to put Method to work for him—he would be Enjoying Today the Rest and Relaxation he Needs and should have.

Yours for success,

E. B. Kelly

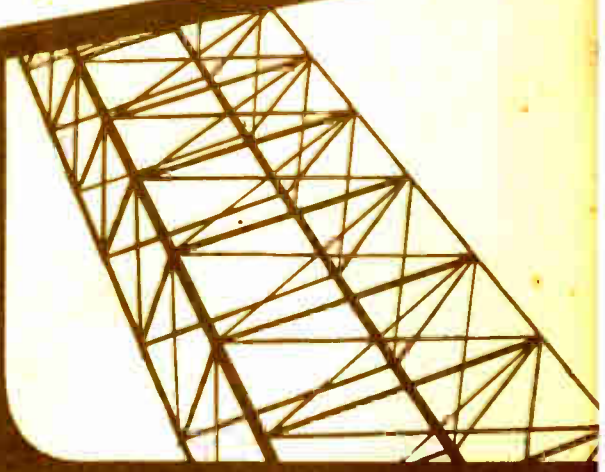
PRESIDENT

PRINTED IN U.S.A

FCC QUESTIONS WITH ANSWERS

Element 3 - Part 2

Lesson ROE - 7



DE FOREST'S RADIO TELEVISION ELECTRONICS TRAINING, INC.

DE FOREST'S TRAINING, INC.

2533 N. Ashland Ave., Chicago 14, Illinois

Lesson ROE-7

FCC Questions with Answers

Element 3 - Part 2

Study Questions 3-61 to 3-120

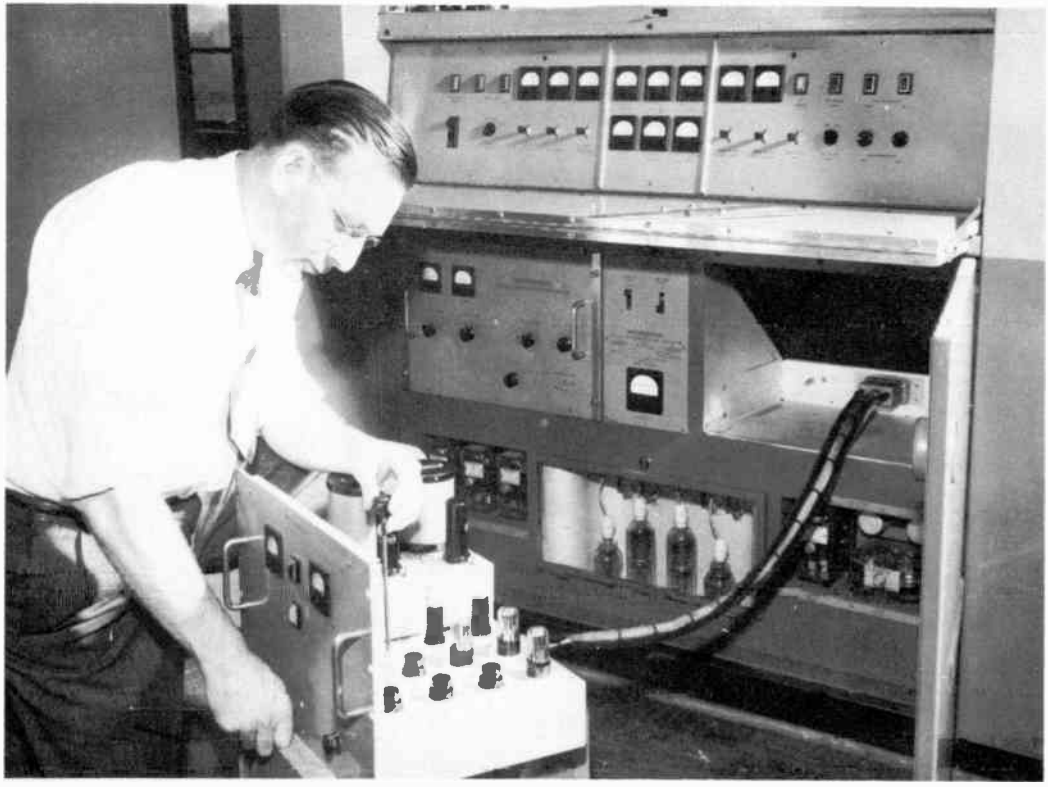
INDEX

"Only great souls know how much glory there is in being good."

—SOPHOCLES

DE FOREST'S TRAINING, INC.

2533 N. ASHLAND AVE., CHICAGO 14, ILLINOIS



An engineer makes a final adjustment of the electronic frequency control unit preparatory to putting the transmitter on the air. Here the frequency control unit has been removed from the cabinet with the aid of a test cable. The master oscillator unit on the left may be removed in the same way.

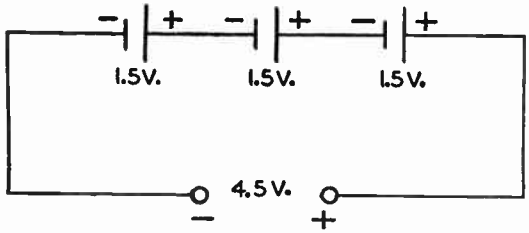
Courtesy Westinghouse

FCC Questions With Answers
Element 3 - Part 2

The contents of this lesson include Study Questions with Answers, Nos. 3-61 to 3-120 inclusive, which relate to subject matter covered by Element 3 of the FCC Commercial Radio Operator's License Examination. Study Questions 3-1 to 3-60 are given in the preceding lesson while those with numbers above 3-120 will be found in following lessons.

3-61

Show by a diagram how to connect battery cells in series.

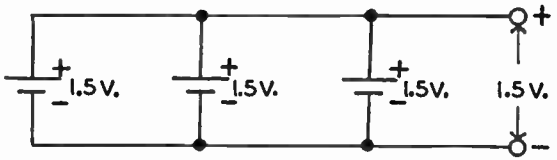


SERIES CONNECTION OF BATTERY CELLS

FIGURE 3-61

3-62

Show by a diagram how to connect battery cells in parallel.



PARALLEL CONNECTION OF BATTERY CELLS

FIGURE 3-62

3-63

What material is used in the electrodes of a common dry cell?

The negative electrode is made of zinc and the positive electrode is made of carbon.

3-64

What form of energy is stored in lead-type storage batteries?

Chemical energy is stored in a lead-acid storage battery by the effect of the charging current upon the chemical composition of the plates and electrolyte. The chemical energy produces an electric potential energy which may be converted into one or more of the different forms of energy, depending upon the load connected to the battery terminals.

3-65

What is the chemical composition of the active material composing the negative plate of a lead-acid type storage cell?

The active material of the negative plate of a lead-acid type storage cell is pure spongy lead.

3-66

What is the chemical composition of the active material of the negative plate of an Edison type storage cell?

The active material of the negative plate of an Edison Cell consists of finely divided iron to which some mercury is added.

3-67

What is the chemical composition of the active material composing the positive plate of a lead-acid storage cell?

The active material of the positive plate of a Lead-Acid type storage cell is Lead Dioxide, (PbO_2).

3-68

What is the chemical composition of the active material composing the positive plate of an Edison type storage cell?

The active material of the positive plate of an Edison Cell consists of nickel dioxide with layers of flaked nickel.

3-69

What is the chemical composition of the electrolyte used in an Edison type storage cell?

The electrolyte of an Edison Cell consists of a 21% solution of Potassium Hydrate in water.

3-70

What is the chemical composition of the electrolyte of a lead-acid storage cell?

The electrolyte of a lead-acid storage cell is a dilute solution of sulphuric acid (H_2SO_4) in distilled water.

3-71

What is the cause of the heat developed within a cell under charge or discharge conditions?

The heat developed is due to the charging or discharging current passing through the internal resistance of the cell and producing power or I^2R losses which are dissipated in the form of heat. Another souce of heat is due to the energy transfer resulting from the chemical reactions while the cell is charging or discharging.

(Under normal conditions of charging or discharging, the amount of heat produced is not great enough to harm the cell, however, excessive current may develop enough heat to cause serious damage and should be avoided.)

3-72

What will be the result of discharging a lead-acid cell at an excessively high current rate.

The effects of an excessively high discharge current are:

(a) Reduction of ampere-hour capacity,
(b) Excessive heating,
(c) Excessive evaporation of water.

(If the cell is overdischarged, an excessive amount of sulphate may be formed.)

3-73

If the charging current through a storage battery is maintained at the normal rate, but its polarity is reversed, what will result?

Reversing the charging current through a storage battery will cause it to discharge, with no damage as long as the discharge is not allowed to become excessive. If the reversed current is permitted to continue, the battery will take on a slight reverse charge and the plates will become badly sulphated. An excessive reversed current may cause the plates to buckle and ruin the battery.

3-74

What are the effects of sulphation?

The effects of sulphation are:

(a) Reduced ampere-hour capacity,

(b) Reduced terminal voltage,

(c) Increased internal resistance,

(d) Possible buckling of the plates.

3-75

What is the effect of local action in a lead-acid storage cell and how may it be compensated?

Local action tends to discharge the cell slowly so that, over a period of time, the capacity of the cell is decreased. The effects of local action in storage batteries may be compensated by keeping them on a trickle charge, that is, supplying them with a continuous, small charging current.

3-76

Why should adequate ventilation be provided in the room housing a large group of storage cells?

The battery room should be well ventilated to allow the explosive gas fumes, generated during the charging process, to escape.

(When storage cells are being charged, the chemical reaction releases large quantities of hydrogen gas, which is highly inflamable and explosive if confined. Fire of any kind should not be permitted in the vicinity of the batteries while they are on charge.)

3-77

When should distilled water be added to a lead-acid storage cell and for what purpose?

Distilled water should be added to a lead-acid storage cell when the level of the electrolyte is below that specified by the manufacturer. At no time should the level of the electrolyte be allowed to fall below the tops of the plates. The water is added so that the electrolyte completely covers the plates and permits the cell to operate at maximum capacity.

3-78

How may the polarity of the charging source to be used with a storage battery be determined?

The polarity of the charging source may be determined with a d-c voltmeter. If such an instrument is not available the polarity may be determined by dipping leads from the source into a glass of water to which a pinch of salt has been added. When there is current between the two leads, bubbles will rise from them and the one giving off the most bubbles is the negative.

3-79

Describe the care which should be given a group of storage cells to maintain them in good operating condition.

Keep the battery room well ventilated—Keep open flames away from the batteries—The electrolyte in the cells should be maintained at the proper level—Charge only at normal rates—Take frequent hydrometer readings—Never allow the cells to stand in a discharged condition—Keep the tops of the cells clean and dry to prevent current leakage—Add only pure distilled water to raise the level of the electrolyte.

3-80

What may cause the plates of a lead-acid storage cell to buckle.

Overdischarge can cause the plates of a lead-acid cell to buckle.

3-81

What may cause "Sulphation" of a lead-acid storage cell?

The most common cause of "Sulphation" in a lead-acid cell is overdischarge.

3-82.

What chemical may be used to neutralize a storage cell acid electrolyte?

Baking soda and ammonia may be used to neutralize the electrolyte of lead-acid cells.

(If the battery acid has been spilled on any part of the body, it should be washed off with large quantities of water before applying the neutralizing chemical.)

3-83

What steps may be taken to prevent corrosion of lead-acid storage cell terminals?

The cell terminals should be cleaned occasionally and coated with plain vaseline or other suitable lubricant. To insure good

electrical contract, the connections should be made before coating the terminals.

3-84

Describe an electrolyte.

An electrolyte is a liquid that is capable of conducting an electric current, but which undergoes chemical decomposition while doing so. Electrolytes usually are water solutions and are employed in plating solutions, dry cells, storage cells and electrolytic condensers.

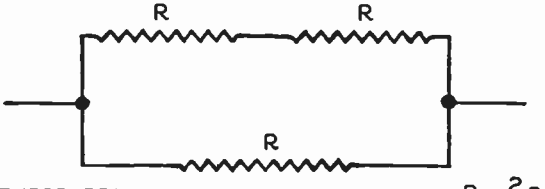
3-85

What is an "A" battery? A "B" battery? A "C" battery?

An "A" battery is used for filament power; it must supply considerable current at a low voltage. A "B" battery is used for plate and screen power and must supply a comparatively low current at a relatively high voltage. A "C" battery is used to supply bias voltages to vacuum tube grid circuits and usually is not required to deliver any current.

3-86

Draw a simple schematic diagram showing the method of connecting three resistors of equal value so that the total resistance will be two-thirds the resistance of one unit.



THREE RESISTORS CONNECTED TO GIVE $R_T = \frac{2}{3}R$

FIGURE 3-86

(In this problem, the total resistance is less than the value of one unit, therefore, the circuit must be a parallel combination.

With only three resistors given, there are only two possible arrangements that will satisfy the problem: three resistors in parallel or two series-connected resistors connected in parallel with the third. In the first case, the total resistance may be determined by dividing the value of one resistor by the number of units in the parallel combination. Assuming the resistors have a value of 1 ohm each, the total resistance is only 1/3 ohm, which is not an answer to the problem.

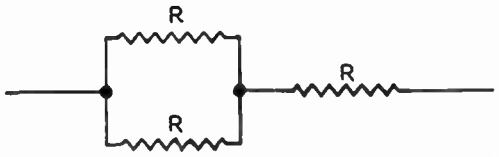
The second arrangement is a two branch parallel circuit in which one branch has a resistance which is double that of the other branch. Assuming each resistor to have a value of 1 ohm, the total resistance may be determined by using the parallel resistor formula and substituting the given values.

$$R_t = \frac{R_1 R_2}{R_1 + R_2} = \frac{1 \times 2}{1+2} = \frac{2}{3} \text{ ohm}$$

Thus, the second possibility is the answer to the problem.)

3-87

Draw a simple schematic diagram showing the method of connecting three resistors of equal value so that the total resistance will be one and one-half time the resistance of one unit.



THREE RESISTORS CONNECTED TO GIVE $R_T = 1\frac{1}{2}R$

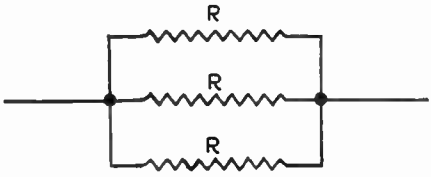
FIGURE 3-87

(Here, the total resistance is greater than the value of one resistor but less than the value of two. Therefore it must be a series-parallel arrangement. With only three resistors given, there is only one possible arrangement that will satisfy the problem: a single resistor connected in series with a parallel combination of the remaining two. Assuming each resistor to have a value

of 1 ohm, the resistance of the parallel combination is one-half ohm. This value added to the one ohm of the third resistor gives a total resistance of one and one-half ohms.)

3-88

Draw a simple schematic diagram showing the method of connecting three resistors of equal value so that the total resistance will be one-third the resistance of one unit.



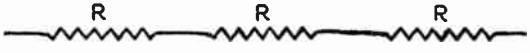
THREE RESISTORS CONNECTED TO GIVE $R_T = \frac{1}{3}R$

FIGURE 3-88

(As in Question 3-86, here again the total resistance is less than the value of one unit, therefore, the circuit must be a parallel arrangement. With only three resistors given, the two possible combinations have total resistances of 1/3 and 2/3 ohm (see Question 3-86 for discussion). Thus, the answer to the question is a parallel group of three resistors.)

3-89

Draw a simple chematic diagram showing the method of connecting three resistors of equal value so that the total resistance will be three times the resistance of one unit.



THREE RESISTORS CONNECTED TO GIVE $R_T = 3R$

FIGURE 3-89

(Here, the total resistance is equal to three times the value of one unit. With only three resistors given, they must be connected in series to obtain the desired value.)

3-90

What is the sum of voltage drops around a simple d-c series circuit, including the source?

The algebraic sum will be zero.

(Kirchoff's Second Law states that the sum of all the electromotive forces around any closed current path is equal to the sum of all the voltage drops around the same path. When the electromotive force of the simple circuit is considered to be positive and the voltage drops to be negative, their algebraic sum is zero.)

3-91

What effect does a change in the dielectric constant of a condenser dielectric material have upon the capacitance of a condenser?

The capacitance of a condenser varies in direct proportion to the dielectric constant. Doubling the dielectric constant doubles the capacitance, while halving it halves the capacitance.

3-92

Explain the effect of increasing the number of plates upon the capacitance of a condenser.

Increasing the number of plates of a condenser will increase the capacitance.

3-93

If the specific inductive capacity of a condenser dielectric material between the condenser plates were changed from 1 to 2, what would be the resultant change in capacitance?

Since the condenser capacitance is directly proportional to the specific inductive capacity (dielectric constant) of the dielectric between the plates, increasing the constant from 1 to 2 will double the capacitance.

3-94

State the formula for determining the quantity or charge of a condenser. The energy stored in a condenser.

The general formula for the charge stored in a condenser is

$$Q = CE$$

where Q = Charge in coulombs,
C = Capacitance in farads,
E = Potential difference in volts.

The general formula for the energy stored in a condenser is

$$W = \frac{Q^2}{2C}$$

where W = Energy in joules,
Q = Charge in coulombs,
C = Capacitance in farads.

3-95

Explain the meaning of the prefix in micro-microfarad.

The prefix micro means one millionth. Thus a micro-micro-farad is one millionth of one millionth of a farad.

3-96

What is the unit of capacitance?

The unit of capacitance is the Farad. Common units are the Microfarad and Micro-microfarad.

3-97

State the three ordinary mathematical forms of Ohm's Law.

The three forms of Ohm's Law are:

$$E = IR \qquad I = \frac{E}{R} \qquad R = \frac{E}{I}$$

3-98

State Ohm's Law.

The magnitude of the current in an electric circuit is directly proportional to the applied voltage and inversely proportional to the circuit resistance.

3-99

If a vacuum tube having a filament rated at ¼-ampere and 5 volts is to be operated from a 6-volt battery, what is the value of the necessary series resistor?

The resistance value must be 4 ohms.

(With a battery emf of 6 volts and a tube rating of 5 volts, there must be a 1 volt drop across the series resistor when the current has a value of ¼-ampere. Therefore,

$$R = \frac{E}{I} = \frac{1}{.25} = 4 \text{ ohms.}$$

3-100

If the voltage applied to a circuit is doubled and the resistance of the circuit is increased to three times its former value, what will be the final current value?

The final current will be 2/3 of the original current.

(Assuming that the original values of voltage and resistance are 1 volt and 1 ohm, the original current

$$I = \frac{1}{1} = 1 \text{ ampere.}$$

Under the conditions of the problem, the voltage and resistance are 2 volts and 3 ohms and the new current

$$I = \frac{2}{3} = \frac{2}{3} \text{ ampere.}$$

3-101

What single instrument may be used to measure (1) Electrical resistance? (2) Electrical power? (3) Electrical current? (4) Electromotive force?

(1) An ohmmeter.
(2) A wattmeter.
(3) An ammeter.
(4) A voltmeter.

3-102

Draw the diagram of an ohmmeter and explain its principle of operation.

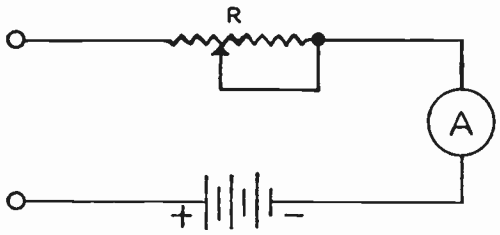


FIGURE 3-102

An ohmmeter is an electrical instrument that indicates the resistance of a circuit or device to which it is connected directly in ohms on a calibrated meter scale. The basic ohmmeter consists of a milliammeter connected in series with a battery and zero adjusting resistor. Before using the ohmmeter, the two terminals are shorted together and the zero adjustment rotated until the meter reads zero resistance, a point corresponding to full scale deflection.

When a resistor or other component is connected between the ohmmeter terminals, the meter will read less than full scale by an amount which depends on the resistance value being measured. Thus the meter scale may be calibrated directly in terms of the added resistance. In an ohmmeter of this type "0" ohms is at the extreme right of the scale, with the numbers increasing toward the left and becoming more crowded as they approach the left end of the scale. Infinite resistance is located at the extreme left of the scale.

3-103

A milliammeter with a full scale deflection of one milliampere and having an internal resistance of 25 ohms is used to measure an unknown current, by shunting it with a 4 ohm resistance. When

the meter reads 0.4 milliampere, what is the actual value of current?

The actual current value is 2.9 milliamperes.

(One method of solving this problem is to consider the meter and shunt as parallel resistors and compute the current in each. Their sum is the total current. The current in the branches of a parallel circuit divides inversely as the resistance, therefore with .4 milliamperes through the meter resistance of 25 ohms, there would be 25 ÷ 4 or 6.25 times this current in the 4 ohm resistor. That is, the 4 ohm resistor carries a current of 6.25 x .4 or 2.5 milliamperes. Adding the 2.5 milliamperes to the .4 milliamperes of the meter, the total current in the circuit would be 2.9 milliamperes.

Another method of solving this problem is to transpose the general formula for meter shunts

$$R_S = \frac{I_m R_m}{I - I_m}$$

into

$$I = \frac{I_m (R_m + R_s)}{R_S}$$

where I = total current,
I_m = meter current,
R_m = Internal resistance of meter,
R_S = resistance of shunt.

Employing the formula, the total current is

$$I = \frac{.4\ (25 + 4)}{4} = \frac{11.6}{4} = 2.9 \text{ ma.}$$

3-104

Which factors determine the amplitude of the emf induced in a conductor which is cutting magnetic lines of force?

The factors controlling the magnitude of induced emf are:

(a) Speed of cutting,
(b) Length of wire in the magnetic field,

(c) Strength of magnetic field,
(d) Angle of cutting.

3-105

A 6-volt storage battery has an internal resistance of 0.01 ohm. What current will flow when a 3-watt, 6-volt lamp is connected?

The current will be .4995 amperes.

(The total current may be determined from $I_t = E/R_t$, where R_t equals the combined resistance of the lamp and battery in series. The resistance of the lamp is

$$R_1 = \frac{E^2}{P} = \frac{6^2}{3} = \frac{36}{3} = 12 \text{ ohms.}$$

The resistance $R_t = 12 + .01 = 12.01$ ohms.
The current

$$I_t = \frac{E}{R_t} = \frac{6}{12.01} = .4995 \text{ amperes.)}$$

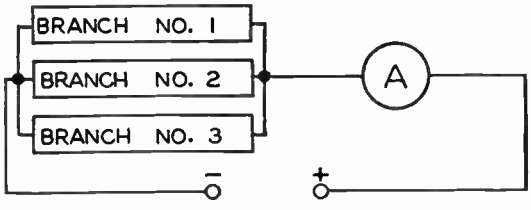
3-106

How may a direct-current milliammeter, in an emergency, be used to indicate voltage?

In an emergency, a d-c milliammeter may be used to indicate voltage by connecting a suitable multiplier resistor in series with the meter.

3-107

Indicate by a diagram how the total current in three branches of a parallel circuit can be measured by one ammeter.



AMMETER CONNECTED TO MEASURE TOTAL CURRENT IN A PARALLEL CIRCUIT

3-108

Describe the construction and characteristics of a D'Arsonval type of meter.

The D'Arsonval type of meter movement consists essentially of a U-shaped permanent magnet, to which are attached two, shaped, soft-iron pole pieces that form a cylindrical opening in the magnetic path. A coil of very fine wire is wound on an aluminum frame and mounted on jeweled bearings so that it is free to rotate in this opening. Two spiral springs, one at each end of the coil, provide an electrical connection to the moving coil and also position the coil at the zero position when there is no current in it. A light-weight pointer is attached to the moving coil to indicate on a calibrated scale the value of the current being measured.

The current that is to be measured is passed through the moving coil, where it produces a magnetic field which is proportional to the magnitude of the current. The magnetic fields of the permanent magnet and the coil react against each other and move the coil against the restraining effects of the two springs. The coil rotation and pointer movement, therefore, depend upon the motor force developed to overcome the resistance of the spiral springs.

The coil frame also performs the function of damping. As the coil moves in the magnetic field, a voltage is induced into the frame. The resulting current produces a magnetic field that opposes the original field of the coil, thus tending to stop the rotation. This action prevents the pointer from swinging back and forth and makes it to come to a stop almost immediately when a reading is taken.

Because it contains a permanent magnet, the D'Arsonval type of meter may be used for d-c measurements only.

3-109

If two voltmeters are connected in series, how would you be able to determine the total drop across both instruments?

This is an application of the Laws of series circuits and the total drop across both voltmeters will be equal to the sum of their readings.

3-110

If two ammeters are connected in parallel, how may the total current through the two meters be determined?

The total current in a parallel circuit is equal to the sum of the currents in the branches therefore the total current in two parallel connected ammeters is equal to the sum of their readings.

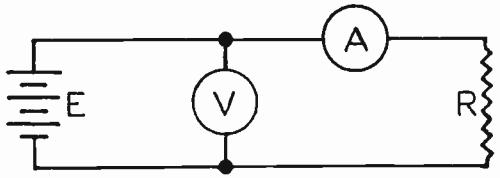
3-111

What is the purpose of a multiplier resistance used with a voltmeter?

A multiplier resistor is used with a voltmeter in order to increase its range and permit readings of higher voltage values.

3-112

Show by a diagram how a voltmeter and an ammeter should be connected to measure power in a d-c circuit.



VOLTMETER AND AMMETER CONNECTED FOR MEASURING POWER IN A D-C CIRCUIT

FIGURE 3-112

3-113

What should be the minimum power dissipation rating of a resistor of 20,000 ohms to be connected across a potential of 500 volts?

The minimum power rating of the resistor should be 20 watts. (The actual power dissipated in the resistor is:

$$P = \frac{E^2}{R} = \frac{500^2}{20000} = \frac{250000}{20000} = 12.5 \text{ watts.}$$

The next larger commercial value is 20 watts and is the one that should employed.)

3-114

If resistors of 5, 3 and 15 ohms are connected in parallel, what is the total resistance?

The total resistance is 1.66 ohms.

(The total resistance may be determined from the conductance formula

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Substituting the given values into the formula:

$$\frac{1}{R_t} = \frac{1}{5} + \frac{1}{3} + \frac{1}{15} = \frac{3}{15} + \frac{5}{15} + \frac{1}{15} = \frac{9}{15} \text{ mho.}$$

Solving for the resistance:

$$\frac{9}{15} \text{ mho} = \frac{15}{9} = 1.66 \text{ ohms.)}$$

3-115

What type of indicating instrument is best suited for use in measuring radio-frequency currents?

The thermocouple type of ammeter is best suited for measuring radio-frequency currents.

3-116

What is the purpose of a "Shunt" as used with an ammeter?

An ammeter shunt is a low resistance current path that is connected across an ammeter in order to permit the measurement of larger values of current.

3-117

If two voltmeters are connected in parallel, how may the total voltage drop across both instruments be determined?

The voltage across the branches of a parallel circuit is the same as the voltage across the entire circuit, therefore the drop across both instruments is the same and the value of the applied voltage is that indicated by either meter.

3-118

If two ammeters are connected in series, how may the total current through the two meters be determined?

This is an application of the Laws of series circuits and the current is the same in both meters.

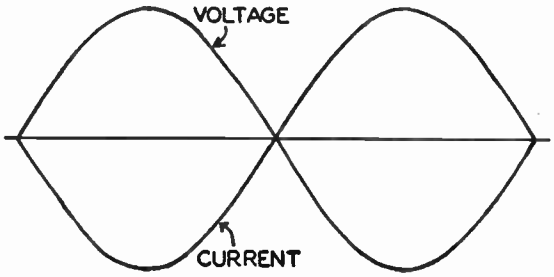
3-119

How can the direction of flow of d-c electricity in a conductor be determined?

By means of a magnetic compass and the left hand rule. The magnetic compass is held either above or below the conductor. The compass needle will try to line up with the magnetic field at right angles to the conductor. The left hand should be placed so the fingers are curved around the conductor and point in the same direction as the North pole of the compass. With the hand in this position, the thumb points in the direction of electron flow.

3-120

Indicate, by drawing, a sine wave of voltage displaced 180 degrees from a sine wave of current.



VOLTAGE AND CURRENT SINE WAVES
DISPLACED 180°

FIGURE 3-120

The 10 practice examination questions at the end of this lesson are of the multiple choice type. Place the number of the selected answer in the space provided at the right of the question.

FROM OUR *President's* NOTEBOOK

IDEALS

It is as natural for young girls to aspire to be actresses, singers or dancers as it is for young boys to look forward to becoming engineers, cowboys or F.B.I. operatives.

The Average girl fails to reach her stage or screen goal and the Average boy settles for much less than he first hoped for because the average individual fails to set up a target that he or she can reasonably hope to hit.

Everyone should have an Ideal—an aim to be somebody above the Average.

Anyone who has such an Ideal and who seriously and earnestly wants to attain it can do so.

It's just a matter of setting up a target and then letting no other influence or interest keep you from eventually hitting it.

You may not get a "Bulls Eye" at first, but the determination that gets you a "Hit" will keep your aim steady until you'll finally get a shot in dead center.

A thing to remember is that a woman can combine a career with being a wife and mother as logically as a man can be a success in profession or business without making him any less a good husband and father.

Yours for success,

Lee De Forest

PRESIDENT

PRINTED IN U.S.A.

FCC QUESTIONS WITH ANSWERS

Element 3 - Part 3

Lesson ROE-8

DE FOREST'S RADIO TELEVISION ELECTRONICS TRAINING, INC.

DE FOREST'S TRAINING, INC.

2533 N. Ashland Ave., Chicago 14, Illinois

Lesson ROE-8
FCC Questions with Answers
Element 3 - Part 3
Study Questions 3-121 through 3-180

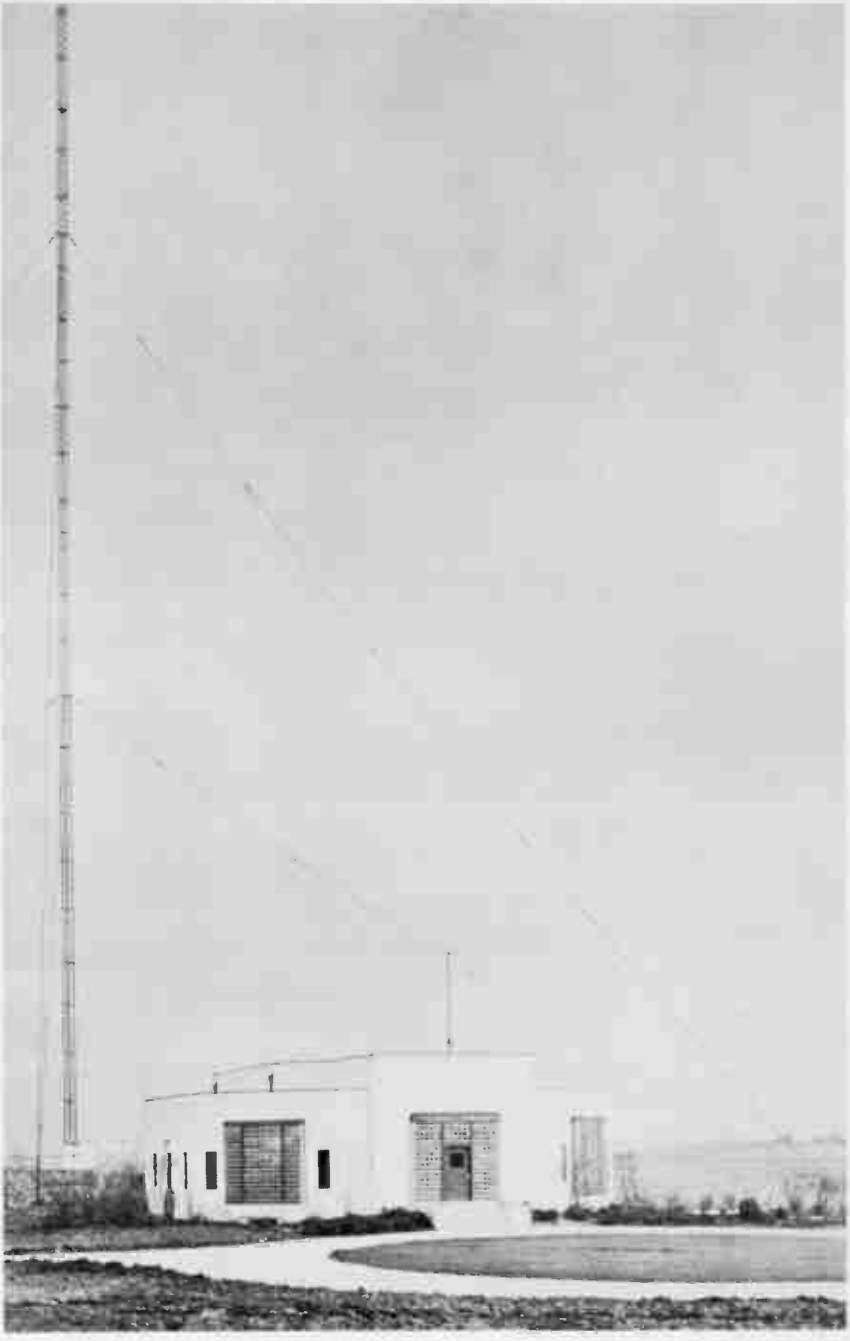
INDEX

"Kites rise against—not with—the wind."

—NEAL

DE FOREST'S TRAINING, INC.

2533 N. ASHLAND AVE., CHICAGO 14, ILLINOIS



ABC-WENR transmitter house and antenna, located in Estes Park, Illinois.
Note the antenna coupling house at the base of the antenna.
Courtesy American Broadcasting Company, Chicago

FCC Questions With Answers Element 3-Part 3

The contents of this lesson include Study Questions with Answers, Nos. 3-121 to 3-180 inclusive, which relate to subject matter covered by Element 3 of the FCC Commercial Radio Operator's License Examination. Study Questions 3-1 to 3-120 are given in preceding lessons while those with numbers above 3-180 will be found in following lessons.

3-121

What instrument is used to measure electric current flow?

An ammeter is used to measure electric current.

3-122

What is the conductance of a circuit if 6 amperes flow when 12 volts d-c are applied to the circuit?

The conductance is 0.5 mho.

(Conductance is the ability of a conductor or circuit to pass an electric current and therefore, is the opposite of resistance. Since resistance is the ratio of the applied voltage to the circuit current ($R = E/I$) and conductance is the opposite of resistance, conductance is the ratio of the circuit current to the applied voltage ($G = I/E$). With the values of current and voltage given, the circuit conductance is equal to

$$\frac{I}{E} = \frac{6}{12} = .5 \text{ mho.)}$$

3-123

If a 0-1 d-c milliammeter is to be converted into a voltmeter with a full scale calibration of 100 volts, what value of series resistance should be connected in series with the millammeter?

The series resistor should have a value of 100,000 ohms, minus the internal resistance of the meter.

(Neglecting the meter resistance, the value of the series resistor, R, may be determined from

$$R = \frac{E_f}{I_f}$$

where E_f is the desired full scale voltage reading and I_f is the full scale current reading of the meter. In this case, the desired full scale voltage is 100 volts and the full scale current is 1 milliampere. Thus,

$$R = \frac{100}{.001} = 100{,}000 \text{ ohms.)}$$

3-124

What is the total resistance of a parallel circuit consisting of one branch of 10 ohms resistance and one branch of 25 ohms resistance.

The total resistance is 7.14 ohms.

(When two unequal resistors are connected in parallel, the most convenient formula to use is

$$R_t = \frac{R_1 R_2}{R_1 + R_2}$$

Substituting the given values into the formula gives:

$$R_t = \frac{10 \times 25}{10 + 25} = 7.14 \text{ ohms.)}$$

3-125

A relay with a coil resistance of 500 ohms is designed to operate when 0.2 amperes flow through the coil. What value of resistance must be connected in series with the coil if operation is to be made from a 110 volt d-c line?

A series resistance of 50 ohms is needed.

(The normal working voltage of the relay coil is equal to 500 x .2 or 100 volts. The remaining 10 volts must be dropped across the series resistor when 0.2 amperes flow. Thus,

$$R_s = \frac{E}{I} = \frac{10}{.2} = 50 \text{ ohms.})$$

3-126

What value of resistance should be connected in series with a 6-volt battery that is to be charged at a 3-ampere rate from a 115-volt d-c line?

The series resistor should have a value of 36.33 ohms.

(The series resistor should drop the difference between 115 and 6 volts, or 109 volts, when the current is 3 amperes. Thus, the resistance is equal to 109/3 or 36.33 ohms.)

3-127

What is the difference between electrical power and electrical energy?

Electrical power is the rate of doing work or consuming energy, while electrical energy is the capacity or ability to do work.

(Electrical power is measured by a unit called a watt, which is the power expended when there is a current of one ampere through a resistance of one ohm. One watt is one joule per second.

Electrical energy is measured by a unit called a joule, which is the amount of energy expended in moving one coulomb of electricity through a resistance of one ohm. The relationship between energy and power is such that 3600 joules equals one watt-hour.)

3-128

What is the unit of electrical power?

The unit of electrical power is the watt or joule-per-second.

3-129

What is the formula for determining the power in a direct-current circuit when the voltage and resistance are known?

$P = \frac{E^2}{R}$, where P is in watts, E is in volts and R is in ohms.

3-130

What is the formula for determining the power in a direct-current circuit when the current and resistance are known?

$P = I^2R$, where P is in watts, I is in amperes and R is in ohms.

3-131

What is the formula for determining the power in a direct-current circuit when the current and voltage are known?

$P = I \times E$, where P is in watts, I is in amperes and E is in volts.

3-132

What instrument measures electrical power.

A wattmeter measures electrical power.

3-133

What instrument measures electrical energy?

A watt-hour meter measures the expenditure of electrical energy.

3-134

Describe the construction and characteristics of a thermocouple type of meter; of a wattmeter.

The thermocouple type of meter operates on the principle that when two dissimilar metals are heated, a difference of poten-

tial will be generated across them. This type of meter is really made up of two units, a thermocouple and a "D'Arsonval" instrument. Current passing through the thermocouple heats the junction of two dissimilar metals and generates a voltage which is impressed across the meter, the pointer of which moves across a calibrated scale.

A wattmeter is a dynamometer-type instrument which is arranged to indicate power by measuring the product of the voltage and current in a circuit. The stationary magnetic field is produced by two coils which are wound with heavy wire and placed end to end, with a small gap between them for the shaft of the moving element. The coils are connected in series-aiding with each other. The moving element consists of a coil of fine wire that is arranged to rotate within the fixed coils, a light aluminum vane that moves inside of an air-tight chamber to provide damping and a pointer which moves over a calibrated scale. Two fine hairsprings provide electrical connections to the coil and also return the coil to zero when there is no current in it.

When the meter is connected into a circuit to measure power, the stationary coils are connected in series with the line and load and produce a magnetic field which is proportional to the load current. At the same time, the movable coil is connected in series with a fixed, non-inductive resistor across the line and produces a magnetic field which is proportional to the line voltage. The two magnetic fields react on each other so that the force trying to turn the coil at any instant is proportional to the product of the instantaneous currents in the fixed and movable coils and, therefore, is proportional $e \times i$, the instantaneous value of power supplied to the load.

In an alternating current circuit, the voltage and current vary from zero to maximum each alternation so that the instantaneous power supplied to the load also varies from zero to maximum each alternation. However, the natural inertia and damping of the moving element permits it to respond only to the average power,

which is equal to EI Cos θ, and thus compensates for power factor so that the true power is indicated.

3-135

If the value of a resistance, to which a constant emf is applied, is halved, what will be the resultant proportional power dissipation?

The resultant power dissipation will be doubled.

(To illustrate, assume a constant emf of 10 volts and an original resistance of 10 ohms. The power dissipated in the resistor may be determined from the formula $P = E^2/R$. Substituting the given values:

$$P = \frac{10^2}{10} = \frac{100}{10} = 10 \text{ watts.}$$

If the resistance is halved,

$$P = \frac{10^2}{5} = \frac{100}{5} = 20 \text{ watts.}$$

Thus halving the resistance, while maintaining a constant voltage, causes the power dissipation to be doubled.)

3-136

What is the maximum rated current carrying capacity of a resistor marked "5,000 ohms, 200 watts"?

The maximum current carrying capacity is .2 ampere (200 milliamperes).

(In this problem, values of resistance and power are given and current is to be found. Therefore, the power formula $P = I^2R$ may be employed by transposing it to $I = \sqrt{P/R}$ and substituting the given values.

$$I = \sqrt{\frac{200}{5000}} = \sqrt{.04} = .2 \text{ amperes.)}$$

3-137

What will be the heat dissipation, in watts, of a resistor of 20 ohms having a current of one-quarter (¼) ampere passing through it?

The heat dissipation will be 1.25 watts.

(With current and resistance given, the power may be determined from the formula $P = I^2R$ by substituting the known values for the letters.

$$P = (¼)^2 \times 20 = (1/16) \times 20 = 20/16 = 1.25 \text{ watts.})$$

3-138

If two 10-watt 500-ohm resistors are connected in parallel, what are the power dissipation capabilities of the combination?

The power dissipation capabilities will be 20 watts.

(The method of connection does not alter the power dissipation capability of a resistor, therefore the total power dissipation capability of two resistors will be equal to the sum of the individual ratings, provided the resistors are of equal resistance and wattage ratings. However, when the resistors have different values of resistance, the total power dissipation capability is not the sum of the individual ratings. This can best be explained by means of an example.

Assume that a 10-ohm 10-watt resistor and a 5-ohm 10-watt resistor are connected in series across a 15-volt battery. The circuit current is equal to 15/15 or 1 ampere. Employing the formula $P = I^2R$, the power dissipated by the 10 ohm resistor is equal to $1^2 \times 10$ or 10 watts and that of the 5 ohm resistor is equal to $1^2 \times 5$ or 5 watts. The maximum power that may be dissipated by the combination is 15 watts, since increasing the applied voltage and circuit current to raise the dissipation in the 5 ohm resistor to 10 watts will cause the 10 ohm resistor to dissipate more than 10 watts. The same results will be obtained if the resistors are connected in parallel.

The maximum power which may be dissipated by any combination of resistors is equal to the sum of the powers actually being dissipated by the resistors and is not equal to the sum of the individual power ratings unless the resistors have equal resistance and power ratings.)

3-139

If the value of a resistance, across which a constant emf is applied, is doubled, what will be the resultant proportional power dissipation?

The resultant power dissipation will be one-half the original value.

(To illustrate, assume a constant emf of 10 volts and an original resistance of 10 ohms. The power dissipated in the resistor is

$$P = \frac{E^2}{R} = \frac{10^2}{10} = \frac{100}{10} = 10 \text{ watts.}$$

When the resistance value is doubled,

$$P = \frac{10^2}{20} = \frac{100}{20} = 5 \text{ watts.}$$

Thus, while maintaining the voltage constant, doubling the resistance causes the power dissipation to be reduced one-half.)

3-140

How much energy is consumed in 20 hours by a radio receiver rated at 60 watts.

1200 watt-hours of energy are consumed.

(To determine the total energy consumed, the wattage rating of the receiver is multiplied by the number of hours it is in use, the result being in watt-hours. Thus: 60 x 20 = 1200 watt-hours.)

3-141

What is meant by the efficiency of a radio device?

The efficiency of a radio device is the ratio of the output power to the input power. That is:

$$\text{Efficiency} = \frac{\text{Output power}}{\text{Input power}}$$

If a percentage figure is desired, the ratio is multiplied by 100.

(For example, find the efficiency of a transformer if the secondary power is 100 watts and the primary power is 105 watts.

$$\text{Efficiency} = \frac{100}{105} \times 100 = 95.2\%.)$$

3-142

What is the formula used to determine the total capacitance of three or more capacitors connected in series?

The equation for condensers in series is

$$C = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}}$$

Where C is the total capacitance and C_1, C_2 and C_3 are the separate capacitors.

3-143

If condensers of 1, 3 and 5 microfarads are connected in parallel, what is the total capacitance?

The total capacitance is 9 microfarads.

(When condensers are connected in parallel, the same voltage is applied across each condenser, as well as the combination. The charge in the combination is equal to the sum of the individual charges and the combination is equivalent to a single condenser having a capacitance equal to the sum of the individual capacitances. Thus,

$$C_t = C_1 + C_2 + C_3 = 1 + 3 + 5 = 9 \text{ microfarads.})$$

3-144

If condensers of 5, 3 and 7 microfarads are connected in series, what is the total capacitance?

The total capacitance is 1.479 microfarads.

(Employing the series condenser formula given in the answer to Question 3-142, the total capacitance is equal to

$$C_t = \frac{1}{\frac{1}{5} + \frac{1}{3} + \frac{1}{7}}$$

The least common denominator is 5 x 3 x 7 or 105, so that

$$C_t = \frac{1}{\frac{21}{105} + \frac{35}{105} + \frac{15}{105}} = \frac{1}{\frac{71}{105}} = 1 \times \frac{105}{71} = 1.479 \text{ microfarads.)}$$

3-145

The charge in a condenser is stored in what portion of the condenser?

The charge of a condenser is stored in the dielectric as an electrostatic stress that represents stored electrical energy.

3-146

Having available a number of condensers rated at 400 volts and 2 microfarads each, how many of these condensers would be necessary to obtain a combination rated at 1,600 volts and 1.5 microfarads?

12 condensers would be needed.

(To operate at 1600 volts, it would be necessary to connect four 400 volt condensers in series. As each condenser has a capacitance of 2 mfd, four of them in series would have a total capacitance of .5 mfd. To obtain a total capacitance of 1.5 mfd, three series combinations, as explained above, connected in parallel, would be required for a total of twelve 400 volt, 2 mfd. condensers.)

3-147

The voltage drop across an individual condenser of a group of condensers connected in series across a source of potential is proportional to what factors?

The voltage drop across a condenser of a group of condensers connected in series across an a-c source of potential is inversely proportional to the ratio of capacitance of the condenser being considered to the total capacitance of the combination and directly proportional to the voltage applied across the combination.

(The voltage across any condenser of a group of series condensers may be determined by employing the general formula

$$E_x = E_a \times \frac{C_t}{C_x}$$

where E_x is the voltage across the condenser in question, E_a is the applied voltage, C_t is the total capacitance and C_x is the capacitance of the condenser in question. C_t and C_x may be in farads, microfarads or micromicrofarads, as long as both are in the same units.

For example, assume that a .25 and a 1 microfarad condenser are connected in series across a 100 volt a-c source. The total capacitance, C_t, is equal to

$$\frac{1}{\frac{1}{.25} + \frac{1}{1}} = \frac{1}{\frac{5}{1}} = \frac{1}{5} = .2 \text{ microfarads.}$$

The voltage across the .25 microfarad condenser will be

$$100 \times \frac{.2}{.25} = 100 \times .8 = 80 \text{ volts.}$$

The voltage across the 1 microfarad condenser will be

$$100 \times \frac{.2}{1} = 100 \times .2 = 20 \text{ volts.)}$$

3-148

What factors determine the charge stored in a condenser?

Referring to the general equation $Q = CE$, it is the capacitance and voltage which determines the charge stored in a condenser.

3-149

Given two identical mica condensers of 0.1 mfd. capacity, each. One of these is charged to a potential of 125 volts and disconnected from the charging circuit. The charged condenser is then connected in parallel with the uncharged condenser. What voltage will appear across the two condensers connected in parallel?

The voltage will be 62.5 volts.

(The charge in the first condenser is $Q = CE = .0000001 \times 125 = .0000125$ coulombs.

When the second condenser is connected in parallel with the first, the total capacitance is doubled but the total charge remains the same, therefore the voltage is

$$E = \frac{Q}{C} \frac{.0000125}{.0000002} = 62.5 \text{ volts.)}$$

3-150

How many micromicrofarads are there in one microfarad?

There are one million micromicrofarads in one microfarad.

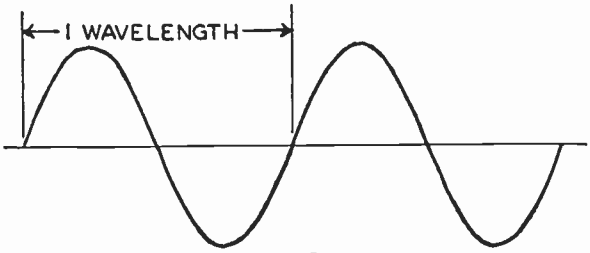
3-151

What precaution should be observed when connecting electrolytic condensers in a circuit?

When connecting electrolytic condensers in a circuit the correct polarity must be observed.

3-152

Indicate, by drawing, two cycles of a radio-frequency wave and indicate one wavelength thereof.



TWO CYCLES OF A RADIO FREQUENCY WAVE WITH ONE WAVELENGTH INDICATED

FIGURE 3-152

3-153

When filter condensers are connected in series, resistors of high value are connected across the terminals of the individual condensers. What is the purpose of this arrangement?

The purpose of these resistors is to insure the correct voltage distribution across the individual condensers.

(If all the condensers of a series connected group had infinite leakage resistance, the applied voltage would divide approximately in inverse ratio to the value of the capacitance, that is, the larger the capacitance value, the smaller the voltage drop for either d-c or a-c. However, instead of having infinite values of leakage resistance, all condensers have a finite leakage resistance which may vary widely between supposedly similar units. When the condensers are connected in series, the leakage resistances form a voltage divider and thus distribute the voltage across the series condensers according to the leakage resistance ratios, rather than the capacitance ratios. To overcome this indeterminate voltage distribution, a resistor having the proper value is connected across each condenser and the resulting voltage divider insures the proper voltage distribution across the individual condensers. If the

voltage ratings of the condensers are equal, the resistors will be of equal value. If the voltage ratings of the condensers are not equal, the values of the resistors must be changed until they provide the proper voltage distribution.)

3-154

May two condensers of 500 volt operating voltage, one an electrolytic and the other a paper condenser, be used successfully in series across a potential of 1000 volts? Explain your answer.

Except in emergencies, such an arrangement is not to be recommended. When two condensers are connected in series across a d-c source, the voltage across them divides in proportion to their leakage resistance. A good electrolytic condenser has a leakage resistance on the order of several thousand ohms, while a paper condenser has a leakage resistance on the order of several megohms. Thus, most of the voltage will appear across the paper condenser and it probably will break down, with the result that the full voltage will be applied across the electrolytic condenser and it also will break down.

In an emergency the series arrangement of an electrolytic and a paper condenser may be operated successfully by connecting a relatively low value (about 100,000 ohms) of equalizing resistor across each condenser.

3-155

State Ohm's Law for alternating current circuits.

In an alternating-current circuit, the current varies directly with the applied voltage and inversely with the impedance.

(The basic formulas are

$$I = \frac{E}{Z}, \qquad E = IZ, \qquad Z = \frac{E}{I}$$

where I is in amperes, E is in volts and Z is in ohms.)

3-156

What is the relationship between the effective value of a radio frequency current and the heating value of the current?

They are the same.

(The effective value of an alternating current is the value that would have the same heating effect as a d-c current of the same value.)

3-157

What is the effective value of a sine wave in relation to its peak value?

The effective value of a sine wave is equal to .707 of the peak value.

3-158

What is the meaning of "Phase Difference"?

Phase difference is a measure in electrical degrees of the separation between similar relative values of two alternating current waves having the same frequency. Phase difference may be expressed as an angle of lead or lag.

3-159

A series inductance, acting alone in an alternating-current circuit, has what properties?

When a series inductance is acting alone in an alternating-current circuit to which a voltage is applied, the resulting current will lag the applied voltage by 90 degrees. The magnitude of the current will vary in direct proportion to the applied voltage and in inverse proportion to the inductance value, frequency and a constant, 2π.

3-160

State the formula to determine the inductive reactance of a coil.

The formula for inductive reactance is

$$X_L = 2\pi fL$$

where X_L is in ohms, f is in cycles per second and L is in henries.

3-161

Neglecting distributed capacitance, what is the reactance of a 5-millihenry choke coil at a frequency of 1,000 kilocycles.

The reactance is 31,400 ohms.

(In order to use the reactance formula, the inductance and frequency must be expressed in henries and cycles per second, respectively. The prefix "Milli" means one one-thousandth, therefore 5 millihenries are 5 one-thousandths of a henry or .005 henry. Kilo means one-thousand, therefore, 1,000 kilocycles are 1,000 thousand or 1,000,000 cycles per second.

The reactance of the choke coil is equal to

$$2\pi fL = 2 \times 3.14 \times 1{,}000{,}000 \times .005 = 31{,}400 \text{ ohms.)}$$

3-162

State the mathematical formula for the energy stored in the magnetic field surrounding an inductance carrying an electric current.

The energy stored in a magnetic field is given by

$$W = \frac{1}{2} LI^2$$

where W is in joules, L is in henries and I is in amperes.

3-163

In a circuit consisting of an inductance having a reactance value of 100 ohms and a resistance of 100 ohms, what will be the phase angle of the current with reference to the voltage?

The current will lag the applied voltage by 45 degrees.

(The phase angle is the angle, the tangent of which is equal to the reactance divided by the resistance or

$$\theta = \tan^{-1} \frac{X}{R} = \tan^{-1} \frac{100}{100} = \tan^{-1} 1 = 45 \text{ degrees}$$

where θ is the phase angle and $\tan^{-1}$ is read "The angle whose tangent is".

Since the reactance is inductive, the current will lag the applied voltage and cause a lagging phase angle.)

3-164

What are the properties of a series condenser, acting alone in an alternating current circuit?

When a series condenser is acting alone in an alternating-current circuit to which a voltage is applied, the resulting current will lead the applied voltage by 90 degrees. The magnitude of the current will vary in direct proportion to the value and frequency of the applied voltage and to the capacitance of the condenser.

3-165

State the formula to determine the capacitive reactance of a condenser.

The formula for a capacitive reactance is

$$X_C = \frac{1}{2\pi fC}$$

where X_C is in ohms, f is in cycles per second and C is in farads. If C is in microfarads, the formula may be written

$$X_C = \frac{1{,}000{,}000}{2\pi fC} \text{ ohms.}$$

3-166

What is the reactance value of a condenser of .005 microfarad at 1,000 kilocycles?

The reactance is 31.8 ohms.

(Employing the second formula of Question 3-165 and substituting the given values, the reactance is equal to

$$X_C = \frac{1{,}000{,}000}{2 \times 3.14 \times 1{,}000{,}000 \times .005} = \frac{1{,}000{,}000}{31{,}400} = 31.8 \text{ ohms.)}$$

3-167

What unit is used to express the alternating current impedance of a circuit?

Alternating current impedance is expressed in ohms.

(The impedance of an a-c circuit is the opposition the circuit offers to an electric current and may be expressed by $Z = E/I$, where Z is the impedance in ohms, E is the applied emf in volts and I is the current in amperes.)

3-168

What is the impedance of a solenoid if its resistance is 5 ohms, and 0.3 amperes flow through the winding when 110 volts at 60 cycles is applied to the solenoid?

The impedance is 367 ohms.

Although the resistance and frequency are given, they are not needed. The impedance is equal to

$$\frac{E}{I} = \frac{110}{0.3} = 367 \text{ ohms.})$$

3-169

What is the meaning of "Power Factor"?

"Power factor" is the factor by which the product of volts and amperes must be multiplied to obtain the true power in an alternating current circuit.

(When an alternating current circuit contains reactance as well as resistance, a phase angle between the voltage and current is introduced so that the actual power being consumed is no longer equal to the product of the voltage and current but is smaller than that value by a factor which depends on the magnitude of the phase angle. This factor is equal to the cosine of the phase angle (θ) between the voltage and current. It may also be expressed as the ratio of the circuit resistance (R) to the circuit impedance (Z) or as the ratio of the true power (P_t), as indicated by a wattmeter, to the apparent power (P_a), as indicated by a voltmeter

and ammeter. The power factor always is less than one and may be expressed as

$$PF = \text{Cos } \theta;\ PF = \frac{R}{Z};\ PF = \frac{P_t}{P_a}.)$$

3-170

What factors must be known in order to determine the power factor of an alternating-current circuit?

In order to determine the power factor of an a-c circuit, the values of true power and apparent power, or the values of resistance and reactance must be known.

(When the two values of power are known, the power factor may be determined by the formula $PF = \frac{P_t}{P_a}$, where P_t is the true power in volt-amperes and P_a is the apparent power in volt-amperes.

If the values of resistance and reactance are known, the power factor may be determined by first computing the circuit impedance from $Z = \sqrt{R^2 + X^2}$, where R is the circuit resistance in ohms and X is the circuit reactance in ohms, and then using the formula $PF = R/Z$.)

3-171

What effect does inductive reactance in an a-c circuit have on the power factor of the circuit?

The presence of inductive reactance in an a-c circuit has a tendency to introduce a lagging phase angle between the voltage and current and may improve or reduce the power factor, depending upon whether or not there is also any capacitive reactance in the circuit. In a circuit containing only inductive reactance and resistance, the power factor will be reduced by the ratio of R to Z, since $PF = R/Z$.

If the circuit has capacitive reactance in addition to inductive reactance and resistance, the inductive reactance may overcome all or part of the capacitive reactance and improve the power factor.

3-172

Given a series circuit consisting of a resistance of 4 ohms, an inductive reactance of 4 ohms and a capacitive reactance of 1 ohm, the applied circuit alternating emf is 50 volts. What is the voltage drop across the inductance?

The voltage drop across the inductance is 40 volts.

(Three steps are required to solve this problem:

Step 1: Find the series impedance from $Z = \sqrt{R^2 + (X_L - X_C)^2}$;

$$Z = \sqrt{4^2 + (4-1)^2} = \sqrt{16 + 9} = \sqrt{25} = 5 \text{ ohms.}$$

Step 2: Find the circuit current from $I = E/Z$;

$$I = \frac{50}{5} = 10 \text{ amperes.}$$

Step 3: Find the voltage drop across the coil from $E_L = IX_L$;

$$E_L = 10 \times 4 = 40 \text{ volts.)}$$

3-173

What is the current and voltage relationship when inductive reactance predominates in an alternating-current circuit?

When inductive reactance predominates in an alternating-current circuit, the circuit current lags the applied voltage by a phase angle which depends on the ratio of the reactance to the resistance.

3-174

If the period of one complete cycle of a radio wave is 0.000001 second, what is the wavelength?

The wavelength is 300 meters.

(Two steps are required to solve this problem. First, find the frequency from the formula

$$f = 1/T; \; f = 1/.000001 = 1{,}000{,}000 \text{ cycles.}$$

Second, find the wavelength (λ) from the formula

$$\lambda = 300{,}000{,}000/f; \; \lambda = 300{,}000{,}000/1{,}000{,}000 = 300 \text{ meters.})$$

3-175

Describe the construction and characteristics of a repulsion type ammeter.

The repulsion type ammeter consists of three major parts: a stationary current coil, a stationary iron vane that is located within the coil and a movable iron vane, with pointer attached, which is mounted close to and concentric with the stationary vane.

The current to be measured is applied to the coil and the resulting magnetic field magnetizes both vanes to the same polarity. The vanes repel each other so that the movable vane changes its position, with the deflection being proportional to the square of the current in the coil. The pointer that is attached to the movable vane indicates the current on a calibrated scale.

This type of meter is suitable only for relatively low-frequency a-c or for d-c measurements.

3-176

Is the angular scale deflection of a repulsion iron-vane ammeter proportional to the square or the square root of the current, or merely directly proportional to the current?

The angular scale deflection of a repulsion iron-vane ammeter is proportional to the square of the current in the stationary coil of the meter.

3-177

Describe the construction and characteristics of a dynanometer-type indicating instrument.

The usual dynamometer-type indicating instrument is a moving coil meter in which the stationary magnetic field is produced by a system of fixed coils instead of a permanent magnet. The stationary element usually consists of a pair of coils which are connected in series-aiding and placed end to end, with a small space between them for the shaft of the moving element. Depending on the meter application, the fixed coils may be wound with heavy or fine wire. Pivoted between jeweled bearings, the shaft of the moving element carries the coil which is wound with fine wire and arranged to rotate within the fixed coils, a light-weight pointer which moves over a calibrated scale and a light aluminum vane that moves inside of an air-tight chamber to provide damping. Two hair-springs provide the electrical connections to the moving coil and return the moving element to the zero position when there is no current in the coil.

In a dynamometer-type voltmeter or ammeter, the fixed and moving coils are connected in series with each other. With the meter connected into the circuit and current in the coils, each coil produces a magnetic field, the strength of which is proportional to the value of the current. The two magnetic fields react on each other so that the force turning the coil is proportional to the square of the instantaneous value of current. In an alternating current circuit, the voltage and current are varying from zero to maximum and back to zero each alternation so that the force trying to turn the coil also varies from zero to maximum and back to zero each alternation. Because of its inertia, the moving element cannot follow the rapid variations but responds to the average value of the squares of the instantaneous values of current and therefore indicates the effective or rms value of current or voltage. A dynamometer-type instrument also may be used as a direct reading wattmeter by connecting the stationary coils in series with the load and connecting the moving coil in series with a resistor

across the line. With current in the coils, the force trying to turn the movable coil at any instant is proportional to the product of the instantaneous current in the fixed and movable coils and, therefore, is proportional to $e \times i$, which is the instantaneous value of power supplied to the load. Because of the inertia and damping of the moving element, the wattmeter reads the average power, which is equal to EI Cos θ, and thus compensates for power factor to indicate the true power.

3-178

Why are copper oxide rectifiers, associated with direct current voltmeters for the purpose of measuring alternating current, not suitable for the measurement of voltages at radio frequencies?

Copper oxide rectifiers are not suitable for use at radio frequencies because of their relatively high capacitance and because the rectifier characteristics vary considerably with temperature.

(The parts of the copper oxide rectifier are very close together and, therefore, have considerable capacitance between them. At power line and low audio frequencies, the reactance of the rectifier capacitance is very high and has little effect on the rectifier operation. However, as the frequency is increased, the reactance decreases until it practically short-circuits the rectifier and prevents it from rectifying the alternating current.)

3-179

Does an alternating-current ammeter indicate peak, average or effective values of current?

An alternating-current ammeter indicates effective (rms) values of current.

3-180

What is the difference between a milliwatt and a kilowatt?

A milliwatt is one one-thousandth of a watt while a kilowatt is one thousand watts.

The 10 practice examination questions at the end of this lesson are of the multiple choice type. Place the number of the selected answer in the space provided at the right of the question.

FROM OUR *President's* NOTEBOOK

FRIENDSHIP

With no intention of painting the finger of criticism at either sex, I have observed that men and women are inclined to look upon Friendships from viewpoints that are quite dissimilar.

The tendency of the average women—from childhood up—is to bestow her friendship upon a single individual at a time—to have her "One Best Friend"—and to confide only in her.

Man—a more gregarious being—cultivates friendships right and left and has dozens of friends—maybe scores—but seldom does any one of them occupy a place in his esteem comparable to his sister's "One Best Friend".

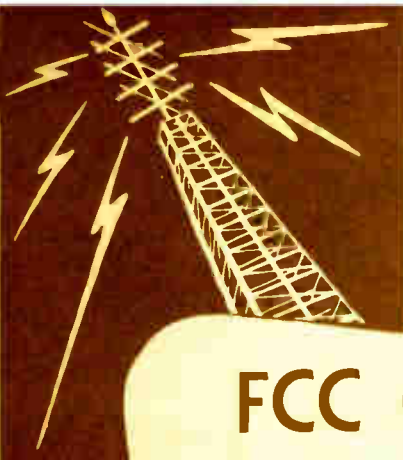
He has business friends, golfing friends, fishing friends, political friends and old school friends. And, if he is at all successful in business, at least a part of his success is due to his having kept all those friendships alive—and in repair.

Yours for success,

E. B. DeForest

PRESIDENT

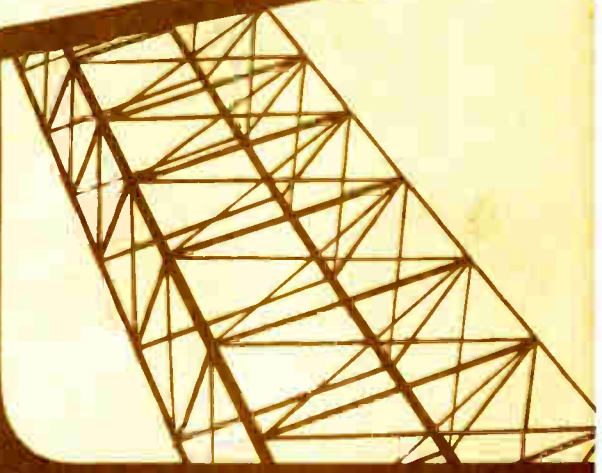
PRINTED IN U.S.A



FCC QUESTIONS WITH ANSWERS

Element 1 - Part 1

Lesson ROE-2



DE FOREST'S RADIO TELEVISION ELECTRONICS TRAINING INC.

DE FOREST'S TRAINING, INC.

2533 N. Ashland Ave., Chicago 14, Illinois

Lesson ROE-2

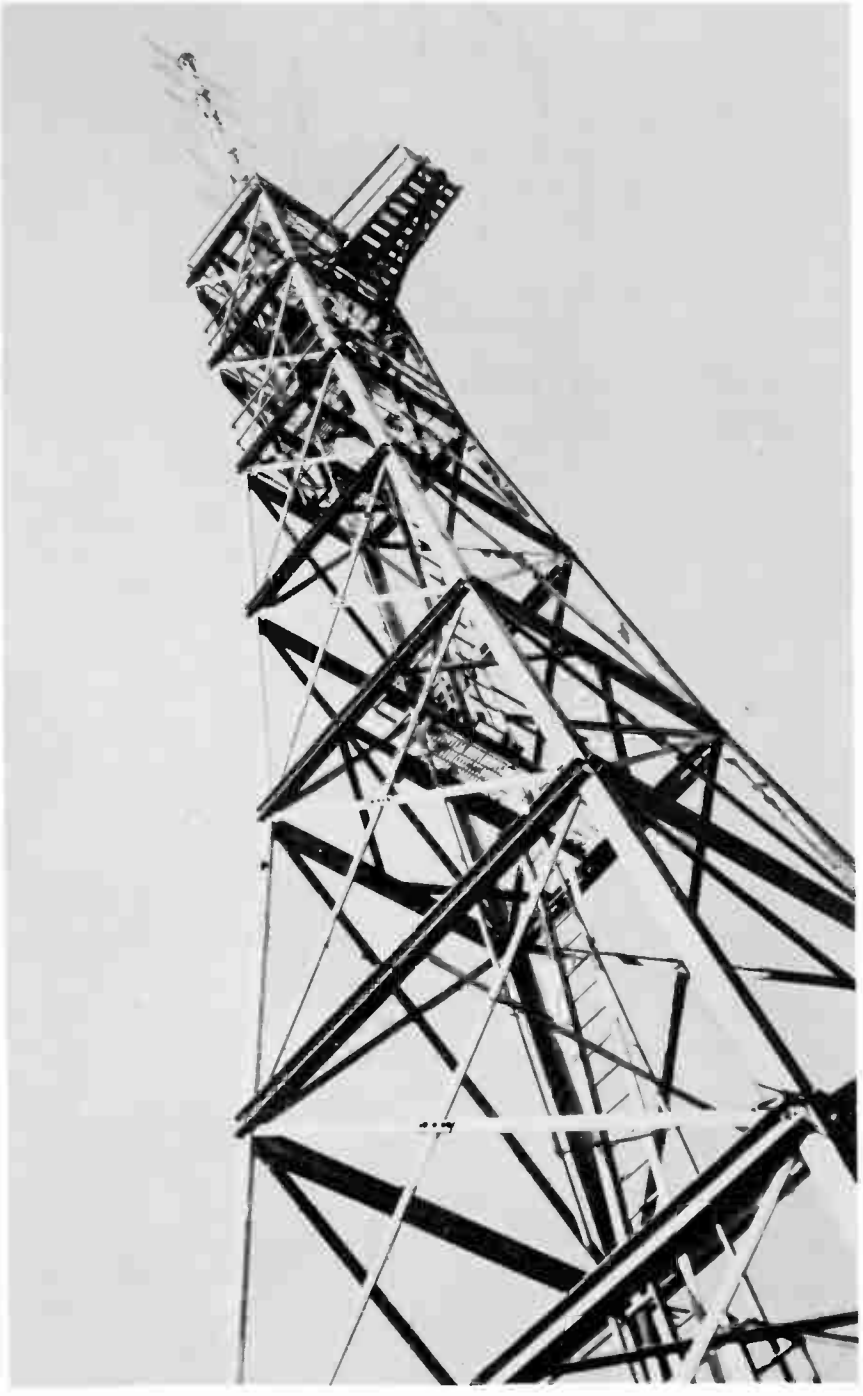
FCC Questions with Answers

Element 1-Part 1

INDEX

"I will utter what I believe today, even though it contradict all I said yesterday."
—PHILLIPS

DE FOREST'S TRAINING, INC.
2533 N. ASHLAND AVE., CHICAGO 14, ILLINOIS



Transmitting tower and antenna of WABD, key station of the DuMont Television Network.
Courtesy DuMont Television Network

FCC Questions with Answers

Element 1- Part 1

As explained in the preceding lesson, commercial radio operator examinations are divided into several numbered elements, each one of which covers a certain phase of the required knowledge. An applicant who is taking the examination must take it element by element, completing one before proceeding to the next. Therefore our lesson plan will follow the same order.

The first section of this material, FCC Questions with Answers, Element 1—Parts 1 and 2, covers basic laws and regulations. The questions cover the entire scope of knowledge required, but they are not the actual questions that will be asked. In many cases, the examination questions may be worded differently or approach the subject from a different viewpoint. However, if the basic law is known and understood, no trouble should be encountered. Therefore, our answer for each question quotes the appropriate law, rule or regulation and should be studied thoroughly.

For identification and reference purposes, each question will be given a double number, the parts of which are separated by a dash. The first part refers to the written examination element number while the second part is our question number. Thus question 1-1 is the first question of element 1 and question 4-80 is the 80th question of element 4.

This lesson contains the first 35 of the element 1 questions' answers. The remainder are in the following lesson.

1-1

State five grounds on any one of which the Federal Communications Commission (FCC) has authority to suspend a radio operator's license or permit.

The Federal Communications Commission has the authority to suspend the license of any operator upon proof sufficient to satisfy the Commission that the licensee—

(A) Has violated any provision of any act, treaty, or convention binding on the United States, which the Commission is authorized to administer, or any regulation made by the Commission under such act, treaty or convention;

(B) Has failed to carry out a lawful order of the master or person lawfully in charge of the ship or aircraft on which he is employed;

(C) Has willfully damaged or permitted radio apparatus or installations to be damaged;

(D) Has transmitted superfluous radio communications or signals or communications containing profane or obscene words, language or meaning, or has knowingly transmitted:

(1) False or deceptive signals or communications;

(2) A call signal or letter which has not been assigned by proper authority to the station he is operating;

(E) Has willfully or maliciously interfered with any other radio communications or signals;

(F) Has obtained or attempted to obtain, or has assisted another to obtain or attempt to obtain, an operator's license by fraudulent means.

1-2

Is an operator subject to the penal provisions of the act if he violates the terms of a radio treaty to which the United States is a party?

Yes. Any person who willfully and knowingly violates any rule, regulation, restriction or condition made or imposed by the Commission on authority of this act, or any rule, regulation, restriction, or condition made or imposed by any international or wire communication treaty or convention, or regulation and act

thereto, to which the United States is or may hereafter become a party, shall, in addition to any other penalty provided by law, be punished, upon conviction thereof, by a fine of not more than $500.00 for each and every day during which such offense occurs.

1-3

State at least two provisions made in the Communications Act to ensure the priority of communications or signals relating to ships in distress.

(A) All radio stations, including government stations and stations on foreign vessels within the territorial waters of the United States, shall give absolute priority to radio communications or signals relating to ships in distress; shall cease all sending on frequencies which will interfere with hearing a radio communication or signal of distress, and, except when engaged in answering or aiding the ship in distress, shall refrain from sending any radio communications or signals until there is assurance that no interference will be caused with the radio communications or siguals relating thereto, and shall assist the vessel in distress, so far as possible, by complying with its instructions.

(B) Stations participating in the mobile service shall be obliged to accept, with absolute priority, distress calls and messages regardless of their origin, to reply in the same manner to such messages, and immediately to take such action in regard thereto as they may require.

(Nothing must stand in the way of sending aid as quickly as possible to a ship in trouble; therefore, distress signals are given absolute priority over all other messages and transmissions.)

1-4

In what class of radio station and under what conditions is an operator permitted to adjust the transmitter for a maximum of radiation without regard to the interference produced?

The transmitting set in a radio station on shipboard may be adjusted in such a manner as to produce a maximum of radiation, irrespective of the amount of interference which may thus be caused, when such station is sending radio communications or signals of distress and radio communciations relating thereto.

1-5

In what cases may a transmitter on shipboard be adjusted to produce a maximum of radiation irrespective of the interference which may be caused?

(See answer to Question 1-4 for the basic law.)

1-6

What communications, if any, are not subject to the secrecy provisions of the Communications Act?

Any radio communication broadcast or transmitted by amateurs or others for the use of the general public, or relating to ships in distress are not subject to the secrecy provisions of the Communications Act.

1-7

State in your own words the prohibition, if any, against the transmission of false calls and communications relating to distress.

No person within the jurisdiction of the United States shall knowingly utter or transmit, or cause to be uttered or transmitted, any false or fraudulent signal of distress, or communication relating thereto.

1-8

State in your own words the law regarding the transmission of false or fraudulent signals of distress or communication relating thereto.

(See answer to Question 1-7 for the basic law.)

1-9

State in your own words the substance of the Communications Act that is provided to ensure the secrecy of radiograms.

No person receiving or assisting in receiving, or transmitting, or assisting in transmitting, any interstate or foreign communications by wire or radio shall divulge or publish the existence, contents, substance, purport, effect or meaning thereof, except through authorized channels of transmission or reception, to any person other than the addressee, his agent, or attorney, or to a person employed or authorized to forward such communication to its destination, or to proper accounting or distributing officers of the various communicating centers over which the communication may be passed, or to the master of a ship under whom he is serving, or in response to a subpoena issued by a court of competent jurisdiction, or on demand of other lawful authority; and no person not being authorized by the sender shall intercept any communication and divulge or publish the existence, contents, substance, purport, effect or meaning of such intercepted communication to any person; and no person not being entitled thereto shall receive or assist in receiving any interstate or foreign communication by wire or radio and use the same or any information therein contained for his own benefit or for the benefit of another not entitled thereto; and no person having received such intercepted communication or having become acquainted with the contents, substance, purport, effect, or meaning of the same or any part thereof, or use the same or any information therein contained for his own benefit or for the benefit of another not entitled thereto.

(Translating the above legal wording into simpler, everyday English, the act states that no person engaged in transmitting or receiving any communication by wire or radio shall disclose, publish or use in any way the information contained in it. Such persons may divulge the contents of the communications only to:

1. The addressee, his agent or attorney.
2. A person authorized to forward the communication to its destination.

3. Proper officers of relaying stations.
4. The master of the ship on which he is serving.
5. A court of lawful jurisdiction, when subpoenaed.
6. Other lawful authorities, but only on demand.

The act also states that unless he is authorized by the sender, a person intercepting the communication shall not disclose, publish or use the information contained in it for the personal benefit of himself or any one else.)

1-10

Does the Communications Act of 1934, as amended, contain any provision that prohibits the interception, use, and publication of radio communications?

Yes. (See Question 1-9 for the basic law.)

1-11

What form of language, if transmitted by an operator or other person, makes him subject to the penal provisions of the Communications Act?

Nothing in this Act shall be understood or construed to give the Commission the power of censorship over the radio communications or signals transmitted by any radio station, and no regulation or condition shall be promulgated or fixed by the Commission which shall interfere with the right of free speech by means of radio communication. No person within the jurisdiction of the United States shall utter any obscene, indecent, or profane language by means of radio communications.

(Although the FCC is not given the power of censorship over radio communications, it is given the power to demand the use of clean language in them.)

1-12

What provisions are made in the Communications Act to ensure intercommunication between stations in the mobile service?

Every land station open to the general public service between the coast and vessels or aircraft at sea shall, within the scope of its normal operations, be bound to exchange radio communications or signals with any ship or aircraft at sea; and each station on shipboard or aircraft at sea shall, within the scope of its normal operations, be bound to exchange radio communications or signals with any other station on shipboard or aircraft at sea or with any land station open to general public service between the coast and vessels or aircraft at sea: Provided, that such exchange of radio communications shall be without distinction as to the radio systems or instruments adopted by each station.

1-13

Does the Federal Communications Commission have authority to issue a radio operator's license or permit to a citizen of a country other than the United States?

No. The Federal Communications Commission has been given authority to issue radio operator's licenses or permits only to citizens of the United States.

1-14

Has the master of a ship radiotelephone station the authority to forbid the transmission of a message by anyone on board?

Yes. The radio installation, the operators, the regulation of their watches, the transmission and receipt of messages, and the radio service of the ship, except as they may be regulated by law or international agreement, or by rules and regulations made in pursuance thereof, shall in the case of a ship of the United States be under the supreme control of the master.

1-15

Has the master of a ship station the authority to regulate the transmissions and reception of messages on shipboard?

Yes. (See answers to Question 1-14 for the basic law.)

1-16

Can any station be licensed under the Communications Act without first obtaining a construction permit from the Federal Communications Commission?

Yes. Government stations, amateur stations, or stations upon mobile vessels, railroad rolling stock or aircraft require no construction permit.

1-17

What class of land stations must, within the scope of normal operations, exchange radio communications or signals with ship and aircraft stations at sea?

Every land station open to general public service between the coast and vessels or aircraft at sea shall be bound to exchange radio communications or signals with ships and aircraft at sea.

1-18

Where Government and private or commercial radio stations on land operate in such close proximity that interference with Government transmission cannot be avoided in simultaneous operation, during what periods must interfering private or commercial stations refrain from operation?

At all places where Government and private or commercial radio stations on land operate in such close proximity that interference cannot be avoided, such private or commercial stations shall not use their transmitters during the first 15 minutes of each hour, local standard time.

1-19

In general, must cargo ships of United States registry of less than 1600 gross tons be equipped with an efficient radio installation in charge of a qualified operator or operators, before leaving or attempting to leave any harbor or port of the United States?

No. An efficient radio installation is not required. However, it is unlawful for any ship of the United States, other than a

cargo ship of less than 1600 gross tons, to be navigated in the open sea outside of a harbor or port without such efficient radio installation in charge of a qualified operator.

1-20

What class of passenger ships of United States registry must be equipped with a radio direction finder apparatus (radio compass) before leaving or attempting to leave a harbor or port of the United States?

Any passenger ship of United States registry of 5000 gross tons or more, leaving a United States port, must be equipped with an efficient radio direction finder.

1-21

How many qualified operators must, for safety purposes, be carried aboard a compulsorily radio equipped ship of United States registry not fitted with an auto-alarm?

For safety purposes, each compulsorily radio equipped ship of United States registry, not fitted with an auto-alarm, shall carry at least two qualified operators.

(Several years ago, at an international radio communications convention, it was generally agreed that, to promote safety at sea, an automatic alarm system should be installed on each ship to monitor the international distress frequency (500 KC) when the operator or operators were not on watch. To operate the alarm system, the distress call must be preceded by the international auto-alarm signal which consists of twelve 4 second long dashes transmitted 1 second apart. When this signal is received, the auto-alarm calls attention to the fact by ringing bells located at various places on the ship. When he hears the alarm bells, the radio operator must return to the radio room and listen for the distress call or message which is to follow.)

1-22

When must the auto-alarm be in operation during the navigation of a ship fitted therewith, outside of a harbor or port?

The auto-alarm must be in operation at all times when the operator is not on watch.

1-23

What is the maximum fine, other than a forfeiture, and the maximum prison sentence provided for a person's willful and knowing violation of the Communications Act?

Any person who willfully and knowingly causes a violation of the Communications Act shall, upon conviction thereof, be punished for such offense by a fine of not more than $10,000 or by imprisonment for a term of not more than two years, or both.

1-24

What is the maximum fine, other than a forfeiture, provided for a willful and knowing violation of a rule or regulation of the Federal Communications Commission, or any treaty or convention to which the United States is a party?

Any person who willfully and knowingly violates any rule imposed by the Commission under authority of this Act shall, in addition to any other penalties provided by law, be punished, upon conviction thereof, by a fine or not more than $500 for each and every day during which such offense occurs.

1-25

Must a person be a citizen of the United States in order to hold any class of radio operator license or permit from the Federal Communications Commission?

Yes, the Federal Communications Commission has been given the authority to license only United States citizens.

1-26

What is the radiotelephony safety signal?

In radiotelephony, the word "Security" (corresponding to the French pronunciation of the word "securite") repeated three times, shall be used as the safety signal.

(The safety signal announces that the station sending it is about to transmit a message concerning the safety of navigation or giving important meteorological warnings and, therefore, precedes the actual message.)

1-27

Under what conditions may a mobile station, if necessary, disregard the General Radio Regulations (Cairo Revision)?

No provisions of these regulations shall prevent a mobile station in distress from using any means available to it for drawing attention, signalling its position and obtaining help.

1-28

What is the radiotelephony urgent signal?

In radiotelephony the urgent signal shall consist of three transmissions of the expression PAN (corresponding to the French pronunciation of the word "panne"); it shall be transmitted before the call.

(The urgent signal indicates that the calling station has a very urgent message to send concerning the safety of a ship, an aircraft or another vehicle, or concerning the safety of some person on board or sighted from on board.)

1-29

What signals and messages are forbidden by international agreement?

The transmission of unnecessary or unidentified signals or correspondence shall be forbidden to all stations.

1-30

What precaution must an operator observe before proceeding with a transmission?

Before transmitting, any station must keep watch over a sufficient interval to assure itself that it will cause no harmful inter-

ference with the transmissions being made within its range; if such interference is likely, the station shall await the first stop in the transmission which it may disturb.

1-31

What does the receipt of the signal "PAN" transmitted by radiotelephony indicate?

The urgent signal shall indicate that the calling station has a very urgent message to transmit concerning the safety of a ship, an aircraft, or another vehicle, or concerning the safety of some person on board or sighted from on board.

1-32

What should an operator do if he intercepts the word "Security" repeated three times?

All stations hearing the safety signal must continue listening on the wave on which the safety signal has been sent until the message so announced has been completed; they must, moreover, keep silence on all waves likely to interfere with the message.

1-33

Under what circumstances may the signal "Security" be transmitted in radiotelephony?

The safety signal "Security" may be transmitted by radiotelephony when the station is about to transmit a message concerning the safety of navigation or giving important meteorological warnings. Hence, it should precede such a transmission.

1-34

The urgent signal sent by an aircraft and not followed by a message indicates what?

In the aeronautical service, the urgent signal PAN shall be used in radiotelegraph and in radiotelephony to indicate that the aircraft transmitting it is in trouble and is forced to land, but that

it is not in need of immediate help. This signal should, so far as possible, be followed by a message giving additional information.

1-35

What obligation rests on an operator intercepting the signal "PAN"?

The urgent signal shall have priority over all other communications, except distress communications, and all mobile or land stations hearing it must take care not to interfere with the transmission of the message which follows the urgent signal.

The remaining questions on Element 1 are in the following lesson.

The questions for Element 1 of the radio operator's license examination are of the essay type that require the applicant to write out the answers, therefore, the examination questions for this lesson are of the same type. Answer each question fully, never using abbreviations or et cetera (etc.) to explain a meaning. Do not be brief.

STUDENT NOTES

STUDENT NOTES

STUDENT NOTES

FROM OUR *President's* NOTEBOOK

GOOD WORK

Much of the satisfaction in life is found in doing, to the very best of our ability, everything we attempt to do. It gives us a gratifying feeling of accomplishment to know our work is thorough, complete and exact in all of its details.

The "Pride in a Job well done" is never experienced by those whose work is careless, slipshod and left unfinished. Their "Good Enough" attitude does nothing to improve their mental or physical well being.

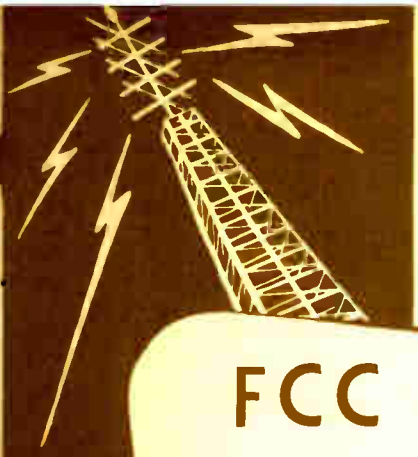
The overall pattern of our advancements—our success, follows very closely the "Well Doing" of those countless little jobs that make up our lives. By doing every little job as well as possible, not only will you be given bigger jobs but you will be prepared to handle them equally well.

Yours for success,

E. B. DeVry

PRESIDENT

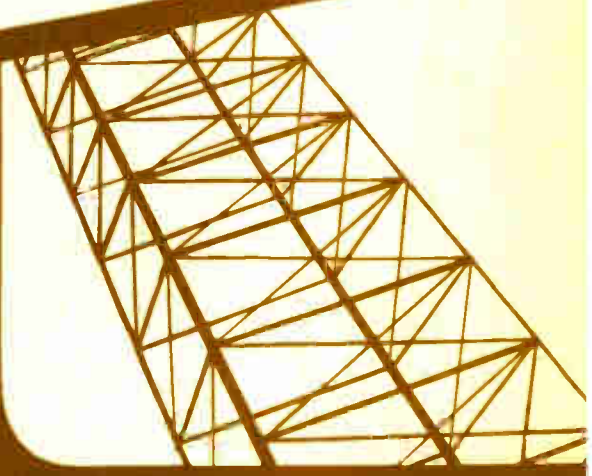
PRINTED IN U.S.A



FCC QUESTIONS WITH ANSWERS

Element 1 - Part 2

Lesson ROE-3



DE FOREST'S TRAINING, INC.

2533 N. Ashland Ave., Chicago 14, Illinois

Lesson ROE-3

FCC Questions with Answers

Element 1 - Part 2

INDEX

"He that will not apply new remedies must expect new evils."

—Bacon

DE FOREST'S TRAINING, INC.
2533 N. ASHLAND AVE., CHICAGO 14, ILLINOIS

This ultra-modern edifice houses all radio, programming and television activities of Westinghouse Station WBZ.

Courtesy Station WBZ-TV, Boston

FCC Questions with Answers

Element 1-Part 2

The contents of this lesson, which include Questions 1-36 to 1-70 inclusive, complete the subject matter covered by Element 1 of the FCC Commercial Radio Operator's Study Guide. Element 1 Questions 1-1 to 1-35 inclusive are given in the preceding lesson.

1-36

What procedure must be followed by a radio station receiving a distress call from a mobile station which is unquestionably in its vicinity?

Stations of the mobile service which receive a distress message from a mobile station which is unquestionably in their vicinity must acknowledge receipt thereof at once. If the distress call has not been preceded by an auto-alarm signal, these stations may transmit this auto-alarm signal with the authorization of the authority responsible for the station, taking care not to interfere with the transmission of the acknowledgement of receipt of said message by other stations.

1-37

What essential information should be transmitted in a distress message?

The distress call must be followed as soon as possible by the distress message, which shall include the distress call followed by the name of the ship, aircraft or the vehicle in distress, information regarding the position of the latter, the nature of the distress, the nature of the help requested and any other information which might facilitate this assistance.

1-38

By what authority may the Operator of a ship or aircraft station transmit a distress call or message?

The distress call and message shall be sent only by the order of the master or person responsible for the ship, aircraft, or other vehicle carrying the mobile station.

1-39

What is the international distress signal to be used in radiotelephony?

In radiotelephony, the distress signal shall consist of the spoken expression MAYDAY (corresponding to the French pronunciation of the expression "m'aider").

1-40

What does the interception of the word "Mayday" transmitted by telephony announce?

This distress signal shall announce that the ship, aircraft, or any other vehicle which sends the distress signal is threatened by serious and imminent danger and requests immediate assistance.

1-41

What radio waves may be used under the provisions of the treaty in transmitting distress messages in case of an emergency by aircraft stations?

Any aircraft in distress must transmit the distress call on the watching wave of the land or mobile stations capable of helping it; when the call is addressed to stations of the maritime service, the waves to be used are the distress-wave or watching-wave of these stations.

1-42

State the priority of radio communications in the mobile service.

The order of priority of radio communications in the mobile service shall be as follows:

(a) Distress calls, distress messages and distress traffic;
(b) Communications preceded by an urgent signal;
(c) Communications preceded by a safety signal;
(d) Communications relative to radio direction-finding bearings;
(e) Government radiotelegrams for which priority rights have not been waived;
(f) All other communications.

1-43

What information must be contained in a distress message, transmitted in an emergency, from a radio station aboard aircraft flying over land?

As a general rule, an aircraft flying over land shall signal its position by the name of the nearest locality, its approximate distance from this point, accompanied, according to the case, by one of the words North, South, East or West, or in some cases, words indicating intermediate directions.

1-44

What information must be contained in a distress message?

(See answer to question 1-37.)

1-45

When, after having sent its distress message, an aircraft station is unable to signal its position, what procedure shall be followed to assist others in determining its approximate location?

When, in its distress message, an aircraft is unable to signal its position, it shall endeavor to send its call signal long enough so that the radio direction-finding stations may determine its position.

1-46

State at least two classes of stations which cannot be operated by the holder of a restricted radiotelephone operator permit.

The holder of a restricted radiotelephone operator permit may not operate any

(a) Station transmitting television.

(b) Station transmitting telegraphy by any type of the Morse Code.

(c) Of the various classes of broadcast stations other than a relay broadcast station.

(d) Coastal telephone station or a coastal harbor station other than in the Territory of Alaska.

(e) Ship station licensed to use telephony for communication with coastal telephone stations.

1-47

Under what conditions may the holder of a restricted radiotelephone operator permit operate a station for which the permit is valid?

The holder of a restricted radiotelephone operator permit may operate any station while using continuous waves without modulation of any kind, telephony, or facsimile emission: Provided that,

(a) Such Operator is prohibited from making adjustments that may result in improper transmitter operation.

(b) The equipment is so designed that none of the operations necessary to be performed during the course of normal rendition of service may cause off-frequency operation or result in any unauthorized radiation.

(c) Any needed adjustments of the transmitter that may affect the proper operation of the station are regularly made by, or in the presence of, an Operator holding a first-

or second-class license, either telephone or telegraph, who shall be responsible for the proper operation of the equipment.

(Because no oral or written examination is required for the restricted radiotelephone operator permit, the person holding it has not proved his ability to adjust a transmitter and therefore is expressly prohibited from so doing.)

1-48

State at least two classes of ship station which the holder of a restricted radiotelegraph operator permit is prohibited from operating.

(a) The permit is not valid for the operation of a ship station licensed to use telephony emission for communication with coastal telephone stations.

(b) The permit is not valid for the operation of a radiotelegraph station on board a vessel required by treaty or statute to be equipped with a radio installation.

(c) The permit is not valid for the operation of any ship telegraph, postal telegraph, or marine-relay station open to public correspondence.

1-49

Who is permitted to make adjustments or tests, in the presence of the licensed Operator responsible for the maintenance of the transmitter and under his responsibility, for the proper operation of the equipment?

The licensed Operator responsible for the maintenance of a transmitter may permit other persons to adjust a transmitter in his presence for the purpose of carrying out tests or making adjustments requiring a specialized knowledge or skill, provided that he shall not be relieved thereby from responsibility for the proper operation of the equipment.

1-50

Within what period of time must the receipt of any official notice of a violation of the terms of the Communications Act of 1934, as amended, Treaty or Rules and Regulations of the Commission be answered?

The official notice must be answered within three days from receipt of such notice.

1-51

What is the obligation of an Operator whose license or permit has been lost, mutilated, or destroyed?

An Operator whose license or permit has been lost, mutilated, or destroyed shall immediately notify the Commission. A sworn application for duplicate should be submitted to the office of issue embodying a statement attesting to the facts thereof. If a license has been lost, the applicant must state that reasonable search has been made, and further, that in the event it is found, either the original or the duplicate will be returned for cancellation. The applicant must also give a statement of the service that has been obtained under the lost license.

1-52

How may the holder of a radiotelegraph or radiotelephone first- or second-class license indicate to representatives of the Commission that he is legally qualified to adjust equipment operated by holders of restricted radiotelephone operator permits?

The holder of a radiotelegraph or radiotelephone first- or second-class license, who is employed as a service and maintenance operator at stations operated by holders of restricted operator permits, shall post at such station his operator license or a verified statement from the Commission in lieu thereof.

1-53

How may an Operator show proof of his legal qualifications to operate a radio transmitter?

The original license of each station Operator shall be posted at the place where he is on duty or kept in his possession in the manner specified in the regulations governing the class of station concerned.

1-54

What is an Operator of a radio station, who has submitted his license for renewal or applied for a duplicate license, required to exhibit as his authority to continue operation of the station pending receipt of the license?

When a duplicate operator license or permit has been requested, or request for renewal upon service has been made, the Operator shall exhibit in lieu thereof a signed copy of the application for duplicate or renewal which has been submitted by him.

1-55

What is the holder of a radiotelegraph or radiotelephone first- or second-class license, who is employed as a service and maintenance operator at stations operated by holders of restricted operator permits, obligated to post at the stations?

His operator license or a verified statement from the Commission. (See answer to Question 1-52 for the basic law.)

1-56

How may corrections be made in a log?

No log or portion thereof shall be erased, obliterated, or willfully destroyed within the period of retention provided by the rules. Any necessary correction may be made only by the person originating the entry who shall strike out the erroneous portion, initial the correction made and indicate the date of the correction.

1-57

Is it lawful to erase an entry made in a station log?

No. (See answer to question 1-56 for the basic law.)

1-58

What are the Commission's requirements with regard to the retention of a radio station log?

Logs of a radio station, when required elsewhere in the rules and regulations to be made or kept, shall be retained by the licensee for a period of 1 year unless otherwise provided by the rules governing the particular service or class of station concerned: Provided, however, that logs involving communications incident to a disaster or which include communications incident to or involved in an investigation by the Commission and concerning which the licensee has been notified, shall be retained by the licensee until specifically authorized in writing by the Commission to destroy them: Provided, further, that logs incident to or involved in any claim or complaint of which licensee has notice, shall be retained by the licensee until such claim or complaint has been fully satisfied or until the same has been barred by statute limiting the time for the filing of suits upon such claim.

(Among the exceptions for particular classes of stations are:

Standard Broadcast Stations,
FM Broadcast Stations,
Non-commercial, Educational FM Broadcast Stations,
Television Broadcast Stations,
International Broadcast Stations.

Ordinarily, these classes are required to retain their logs for two years.)

1-59

How long must the licensee retain a station log which involves communications incident to a disaster?

Logs which contain communications incident to a disaster must be retained until the Commission gives written permission that they may be destroyed. (See answer to Question 1-58 for complete law.)

1-60

What is the Commission's rule with regard to rough logs?

Rough logs may be transcribed into condensed form, but in such case the original log or memorandum and all portions thereof shall be preserved and made a part of the complete log.

1-61

What procedure should one follow if he desires to resist an order of suspension of his Operator's license or permit?

No order of suspension of any Operator license shall take effect until 15 days' notice in writing thereof, stating the cause for the proposed suspension, has been given to the Operator licensee who may make written application to the Commission at any time within said 15 days for a hearing upon such order. The notice to the Operator licensee shall not be effective until actually received by him, and from that time he shall have 15 days in which to mail the said application.

In the event that physical conditions prevent mailing the application before the expiration of the 15 day period, the application shall then be mailed as soon as possible thereafter, accompanied by a satisfactory explanation of the delay. Upon receipt by the Commission of such application for hearing, said order of suspension shall be held in abeyance until the conclusion of the hearing which shall be conducted under such rules as the Commission shall deem appropriate. Upon the conclusion of said hearing the Commission may affirm, modify or revoke said order of suspension.

If the license is ordered suspended, the Operator shall send his operator license to the office of the Commission in Washington, D. C. on or before the effective date of the order or, if the effective date has passed at the time notice is received, the license shall be sent to the Commission forthwith.

(When a licensed radio operator commits an act for which his license may be suspended, the FCC does not revoke it immediately

but gives the operator a chance to defend himself. He is given 15 days in which to prepare a defense and present it at a hearing. The final decision is not made until after the hearing. Then if the license is suspended, the Operator must return it to the Commission.)

1-62

What is the responsibility of a licensee of a radio station with respect to permitting it to be inspected by representatives of the Commission?

The licensee of any radio station shall make the station available for inspection by representatives of the Commission at any reasonable hour and under the regulations governing the class of station concerned.

1-63

Who is responsible for the control of distress traffic?

The control of distress traffic shall devolve upon the mobile station in distress or upon the station which by application of the provisions of Section 2.61 has sent the distress call. These stations may delegate the control of the distress traffic to another station. (Note: Section 2.61 is quoted as the answer of Question 1-66.)

1-64

Are logs subject to inspection by representatives of the Commission?

Yes. Each log shall be kept by the person or persons competent to do so, having actual knowledge of the facts required, who shall sign the log when starting duty and again when going off duty. The logs shall be made available upon request by an authorized representative of the Commission.

1-65

By whom may the log of a radio station be kept?

Any person who has knowledge of the facts required. (See answer to question 1-64 for the basic law.)

1-66

Under what conditions may a distress message be retransmitted?

Any station which becomes aware that a mobile station is in distress may transmit the distress message in the following cases:

(a) When the station in distress is not itself in a position to transmit the message.

(b) In the case of mobile stations, when the master or the person in charge of the ship, aircraft or other vehicle carrying the station which intervenes, believes that further help is necessary.

(c) In the case of other stations, when directed to do so by the station in control of distress traffic or when it has reason to believe that a distress call which it has intercepted has not been received by any station in a position to render aid.

1-67

What tolerance in operating power is permissible under normal circumstances?

The operating power of all radio stations shall be maintained within the following tolerance of the assigned power:

(a) When the maximum power only is specified, the operating power shall not be greater than necessary to carry on the service and in no event more than 5% above the maximum power specified.

(b) When an exact power is specified, the operating power shall not be more than 5% above or less than 10% below such power.

1-68

Under what conditions may a station be operated in a manner other than that specified in the station license?

The licensee of any station, except amateurs, may, during a period of emergency in which the normal communication facilities

are disrupted as a result of a hurricane, flood, earthquake or similar disaster, utilize such station for emergency communication service in communicating in a manner other than that specified in the station license, provided:

(a) That as soon as possible after the beginning of such emergency use notice be sent to the Commission in Washington, D. C., and to the Inspector in charge of the district in which the station is located, stating the nature of the emergency and the use to which the station is being put, and

(b) that the emergency use of the station shall be discontinued as soon as substantially normal communication facilities are again available and the Commission in Washington, D. C., and the Inspector in charge be notified immediately when such special use of the station is terminated. The Commission may at any time order the discontinuance of such service.

1-69

What is the Commission's rule with respect to measurement of the radio station frequency?

The licensee of each station shall provide means for the measurement of the station frequency. The measurement of the station frequency shall be made by means independent of the frequency control of the transmitter and shall be conducted in accord with the regulations governing the class of station concerned.

1-70

When may operation be resumed after a station has been notified to cease transmission because of interference to distress traffic?

No station, having been notified to cease operation, shall resume operation on frequency or frequencies which may cause interference until notified by the station issuing the original notice that the station involved will not interfere with distress traffic as it is then being routed or until receipt of a general notice that the need for handling distress traffic no longer exists.

FROM OUR *President's* NOTEBOOK

HASTE

The time-worn admonition that mothers used to quote to their doughters about "marrying in haste and repenting at leisure" is seldom heard or seen in print ony mare.

The reason is, perhaps, that there's no such thing now-a-days os leisure for even the mast worthy af purposes.

We're becoming a Nation of "Rocers".

We hurry to everything. We even hurry to WORK. That, in itself is well enough, but having arrived ot our jobs, we hurry so to accomplish them, we slight too many of our duties that we con't get done in record time.

Now isn't it better to get o little less dane—spend more time doing it—or get it done a little later than to do things only holf as well os we know how to do them?

And isn't it o pretty sofe conclusion that a job that isn't well done (becouse it's dane hostily) is going to be o job that we'll hove to do All Over Again?

Yours for success,

L. B. deForest

PRESIDENT

PRINTED IN U.S.A

FCC Questions with Answers

Element 2 - Part 1

Lesson ROE-4

DE FOREST'S RADIO TELEVISION ELECTRONICS TRAINING, INC.

DE FOREST'S TRAINING, INC.

2533 N. Ashland Ave., Chicago 14, Illinois

Lesson ROE-4

FCC Questions with Answers

Element 2 - Part 1

INDEX

"What we hope ever to do with ease, we must first learn to do with diligence"
—JOHNSON

DE FOREST'S TRAINING, INC.
2533 N. ASHLAND AVE., CHICAGO 14, ILLINOIS

Interior of the Transmitter Building of DuMont Station WDTV at Pittsburg.
Courtesy DuMont Television Network

FCC Questions with Answers

Element 2-Part 1

The Questions and Answers of this and the following lesson cover the scope of the knowledge required for Element 2, Basic Radiotelephone Operating Practice of the FCC Commercial Radio Operator Examination.

For all except Element 1, the FCC examination questions are of the multiple choice type. That is, the question is stated along with several possible answers. In all cases, only one of the given answers is completely correct and must be selected by the license applicant. Therefore, to provide greater preparation, in the practice examinations of this and following lessons, the questions are multiple choice.

To present the required subject matter more completely, essay type answers are given for the numbered element questions. These answers require careful and thorough study because the official FCC examination questions may differ in wording or approach the particular subjects from different viewpoints than the study questions. Therefore if the answers are understood, not memorized, the information they contain will enable the applicant to pass this element examination without difficulty.

2-1

For what term are commercial radio operator licenses normally issued?

Commercial operator licenses normally are issued for a term of 5 years from the date of issuance.

2-2

Is the holder of a radiotelephone third-class operator permit authorized to make technical adjustments to the transmitter he operates?

Technical repairs or adjustments to radiotelephone communication stations may be made by persons holding a radiotelephone operator third-class permit but only under the immediate supervision and responsibility of operators holding first- or second-class licenses.

(Because an applicant is required to pass only written examination elements 1 and 2 to obtain a radiotelephone third-class operator permit, he does not prove a knowledge of and the ability to make technical adjustments on a transmitter and therefore is prohibited from making them, except under direct supervision of a qualified person.)

2-3

List three classes of stations which may not be operated by the holder of a radiotelephone third-class operator permit.

The holder of a radiotelephone third-class operator permit may not operate any—

(1) Stations transmitting television,
(2) Stations transmitting telegraphy by any type of the Morse Code,
(3) Any of the various classes of broadcast stations other than non-commercial educational FM broadcast stations using transmitters with power rating of 10 watts or less, remote pickup broadcast stations and broadcast studio-to-transmitter link stations,
(4) Coastal telephone stations at which the power in the antenna of the unmodulated carrier is authorized to exceed 250 watts,
(5) Coastal telephone stations or coastal harbor stations other than in the Territory of Alaska,

(6) Ship stations licensed to use telephony for communications with coastal telephone stations,

(7) Amateur.

2-4

How often should station indentification be made at a base or land radiotelephone communication station?

Stations capable of being identified by transmission of their assigned call signal shall transmit such call signals at the end of each transmission, or exchange of transmissions, or once each fifteen minutes of the operating period, as the licensee may prefer.

2-5

What broadcast stations, if any, may be operated by the holder of a radiotelephone third-class operator permit?

The only broadcast stations which a holder of a radiotelephone third-class operator permit may operate are

(1) Non-commercial educational FM stations using transmitters with power ratings of 10 watts or less,

(2) Remote pickup stations,

(3) Studio-to-transmitter links.

2-6

What daily attention should be given to the antenna tower lights at a radio station?

The licensee of any station which has an antenna or antenna supporting structure required to be illuminated by the terms of the station authorization, shall make a daily check of the tower lights either by visual observation of the tower lights or by observation of an automatic indicator which shows whether the tower lights are operating properly.

(Antenna tower lights are required on most transmitter antennas that exceed a certain height. They are used for marking the location of the antenna at night so that aircraft pilots will be

warned of the obstruction. As a safety measure, the antenna tower lights are checked at least once a day and any failure that cannot be corrected within half an hour reported to the nearest Airways Communication Station or office of the Civil Aeronautics Administration for transmission to all aircraft in the vicinity.)

2-7

What should an operator do if he observes any failure of a code or rotating beacon light at the radio station he operates?

He shall report immediately by telephone or telegraph to the nearest Airway Communication Station or office of Civil Aeronautics Administration any observed failure of a code or rotating beacon light not corrected within 30 minutes, regardless of the cause of such failure. Further notification shall be given immediately upon resumption of the required illumination.

2-8

What entries regarding tower lights are required in station records or logs for stations whose antenna or antenna supporting structure is required to be illuminated?

(1) The time the tower lights are turned on and off each day, if manually controlled.

(2) The time the daily check of proper operation of the tower lights was made.

(3) In the event of any observed failure of a tower light;
   (a) Nature of such failure.
   (b) Date and time the failure was observed.
   (c) Date, time and nature of the adjustments, repairs or replacements made.
   (d) Identification of Airway Communication Station (Civil Aeronautics Administration) notified of the failure of any code or rotating beacon light not corrected within thirty minutes, and the date and time such notice was given.

(e) Date and time notice was given to the Airways Communications Station (CAA) that the required illumination was resumed.

(4) Upon completion of the periodic inspection required at least once each three months:

(a) The date of the inspection and the condition of all tower lights and associated tower lighting control devices, together with the socket voltages measured under load at the sockets or computed from measurements under load at other points.

(b) Any adjustments, replacements or repairs made to insure compliance with the lighting requirements and the date such adjustments, replacements, or repairs were made.

2-9

Should a radio station that is operated by a licensed radio operator be a licensed radio station?

Yes. In the words of the Communications Act of 1934, as amended, no person shall use or operate any apparatus for the transmission of energy or communications or signals by radio

(a) from one place in any Territory, or possession of the U. S. to another place in the same Territory, or possession; or

(b) from any place in any State, Territory, or possession of the U. S. to any place in any foreign country or to any vessel; or

(c) within any State when the effects of such use extend beyond the border of said State; or

(d) upon any vessel or aircraft of the U. S.; or

(e) upon any mobile stations within the jurisdiction of the U. S., except under and in accordance with this Act and with a license in that behalf granted under the provisions of this act.

(This simply means that every radio station, no matter what

its purpose, must be licensed by the FCC before it can be operated in any Territory, District or State or on any vessel or aircraft of the United States.)

2-10

Why is it important to avoid unnecessary calls by radio-communications?

In order to prevent interference and to give others an opportunity to use the airways the operator should avoid unnecessary calls and communications by radio.

2-11

Is it advisable to be courteous in radio communication as it is in other forms of communication?

Yes, in radio communications the operator should be courteous at all times.

2-12

Why is it a good policy to be brief in radiotelephone conversation?

It is a good policy to be brief in radiotelephone conversation so that any interference with other communication services may be kept at a minimum.

2-13

Immediately prior to calling a station why should the operator listen on the operating frequency?

Before making a radio call the operator should listen on the communications channel for a sufficiently long interval to insure that interference will not be caused to communications which may be already in progress.

2-14

State two reasons why station indentification should be clearly made by a radio transmitting station.

Station identification should be made clearly and distinctly so that unnecessary repetition of call letters is avoided and to enable monitoring stations to identify clearly all calls.

2-15

Why is it advisable during your absence from your radiotelephone equipped vehicle always to lock the cab or compartment in which the radio equipment is locked?

A radio transmitter should at all times be either attended by or supervised by a licensed operator or the transmitter should be made inaccessible to unauthorized persons, by locking the cab or compartment in which the radio equipment is located.

2-16

Why is it undesirable to leave a radiotelephone communications transmitter on the air during periods when voice transmissions are not in progress?

It is undesirable to leave a radiotelephone transmitter on the air during periods when voice transmissions are not in progress because, it may cause interference with other services. The operator of a radiotelephone station should not press the "push-to-talk" button except when he intends to speak into the microphone.

2-17

When routine radio communications are unreliable due to static or fading, should the operator continue transmitting or wait for more favorable conditions?

When radio communications at a station are unreliable or disrupted due to static or fading, it is not a good practice for the operator to call other stations continuously in attempting to make contact because his calls may cause interference to other stations that are not experiencing static or fading.

2-18

Are there any ill effects to radio communications if the operator shouts into the microphone?

Yes. When the operator shouts into the microphone, the transmitter may be overloaded so that the signals become distorted

beyond intelligibility. Thus, instead of increasing the distance range by shouting into the microphone, the range may be reduced to zero. The best practice is to use a normal speaking voice.

2-19

Is the working distance range of a transmitter affected by the loudness of speech spoken into the microphone?

Yes, the working distance range of the transmitter is affected to some extent by the loudness of the speaker's voice; if the voice is too low the maximum distance range of the transmitter cannot be attained and if the voice is too loud the distance range may be reduced to zero due to the signals becoming distorted beyond intelligibility.

2-20

Is it a good practice to shield the microphone with the hands when speaking into a microphone in a noisy location?

Yes. By cupping the hands around the microphone much of the extraneous noise is excluded.

2-21

When using the microphone at a radiotelephone station, should the operator speak directly into the microphone or away from the microphone?

Normally a communications microphone is spoken directly into, however, in some of the older microphones, such as carbon button types, the operator speaks across the microphone so that his breath does not strike the microphone directly.

2-22

For most effective operation how far should the microphone be held from the speaker's lips?

Normally a communications microphone is held 2 to 6 inches from the speaker's lips.

2-23

When speaking over a radiotelephone communications station how should the operator adjust his voice, that is, should he speak in one tone of voice as much as possible or should he articulate all his words and expressions?

A radiotelephone operator should make an effort to train his voice for most effective radiocommunications. His voice should be loud enough to be heard distinctly by the receiving operator but it should not be too loud since it may become distorted and difficult to understand at the receiving station. He should articulate his words and avoid speaking in a monotone as much as possible.

2-24

In radiotelephone communications why should the operator use well known words, and phrases and simple language as much as possible?

In radiotelephone communications it is important that operators use familiar and well known words and phrases in order to insure accuracy and save time from undue repetition of words.

2-25

What is meant by a phonetic alphabet in radiotelephone communications?

In radiotelephone communications, a phonetic alphabet is a word list, each word of which is distinctive and starts with the letter which it is to identify. It is very useful in identifying letters that may sound like other letters. For example, in spelling out an unusual name or word, the transmitting operator may say the letter C. In transmission, the letter may become distorted slightly so that the receiving operator doesn't know whether the letter is C, D, E, G, P, T or Z. Using the phonetic alphabet, the letter C might be transmitted as "C as in Charlie", thus reducing greatly

the chance of error. A commonly employed phonetic alphabet is given below.

A—Adam	J—John	S—Susan
B—Baker	K—King	T—Thomas
C—Charlie	L—Lewis	U—Uncle
D—David	M—Mike	V—Victor
E—Edward	N—Nancy	W—William
F—Frank	O—Oboe	X—X-ray
G—George	P—Peter	Y—Young
H—Henry	Q—Queen	Z—Zebra
I—Ida	R—Roger	

2-26.

Give an example of the use of a phonetic alphabet in transmitting a word that is difficult to understand.

To insure correct reception and spelling the word "Group" may be transmitted as "GROUP, G AS IN GEORGE, R AS IN ROGER, O AS IN OBOE, U AS IN UNCLE, P AS IN PETER".

2-27

What is indicated by the transmission of the word "Roger" as the reply to a radiotelephone communications?

"Roger" means "I have received all of your last transmission".

(In order to insure accuracy and to save time by eliminating undue repetition of words, some radio operating companies, services, networks and associations have adopted standard procedure words and phrases for use in radiotelephone conversations. A few of the standard procedure words are Roger, Over, Out and Wilco.)

2-28

What is the significance of the word "over" when transmitted at the end of a radiotelephone communication?

"Over" means "My transmission is ended, and I expect a response from you".

2-29

What is indicated by the word "Out" when transmitted at the end of a radiotelephone communication?

"Out" means "This conversation is ended and no response is expected".

2-30

Frequently the word "Wilco" is used in radiotelephone communications. Is this word generally used as a phonetic or is it used as a procedure word? What does it mean?

"Wilco" is a standard procedure word and means "Your last message received, understood, and will be complied with".

In the FCC examination, the questions of all elements except number 1 are of the multiple choice type. Therefore, the 10 examination questions at the end of this lesson are of the same type. Read the questions and answers carefully and then decide which answer completely satisfies the question. Insert the number of the selected answer into the space provided at the right of the question.

FROM OUR *President's* NOTEBOOK

LABOR

I can recall neither when nar where I ance saw a printed and framed matta reading:

"Wark is nat man's Punishment; it is his Reward and his Strength—his Glary and his Pleasure."

I was impressed, but at the time, unconvinced, far I was many years younger than I am now. Fram my yauthful viewpaint, I could nat see haw wark could be anything but a tharaughly Tiresame and Distasteful means af securing Faad, Clathing, Shelter and the ather mare impartant necessities af life such as Entertainment.

But the fact remains that I did remember it—ward far ward—and in the intervening years I've faund it all true. But in the light af experience I'd nat say it in thase same wards. I'd put it this way:

Find the wark you lave ta da
And na task will seem hard far you,
And far each Ounce af effart spent
You'll reap a pound af Pure Cantent.

Yours for success,

E. B. DeVry

PRESIDENT

PRINTED IN U.S.A.