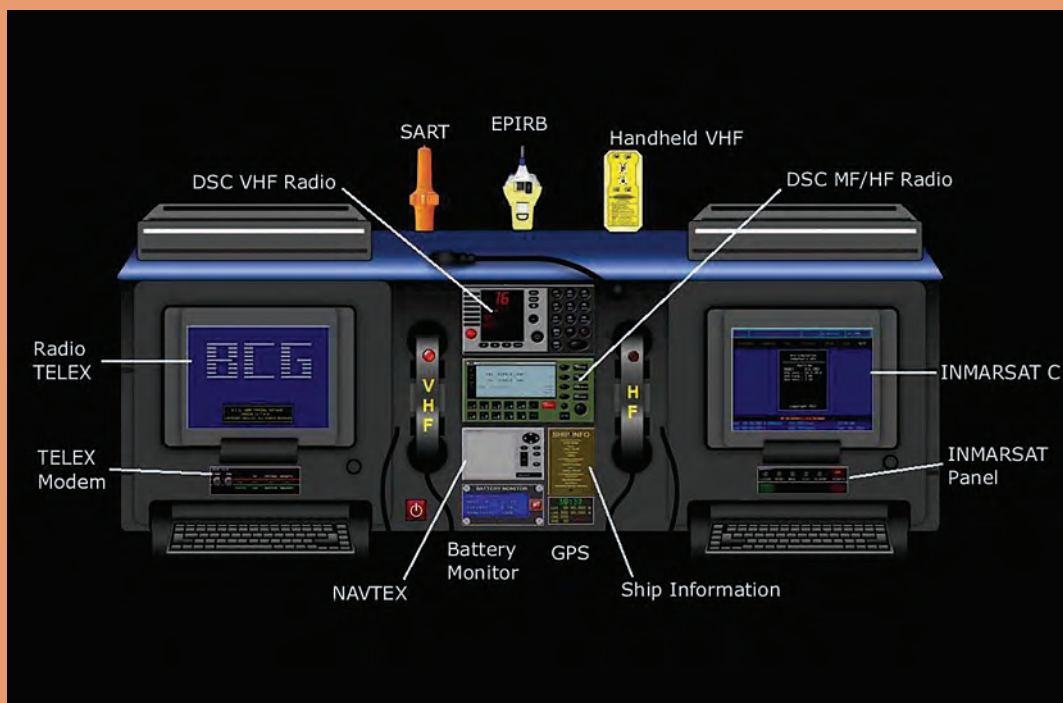


پودمان ۵

کسب اطلاعات فنی



کسب اطلاعات فنی

کسب اطلاعات فنی، شایستگی درک و دریافت دانش از منابع مختلف فارسی و غیر آن می‌باشد. با پیشرفت و گسترش و تنوع منابع، ضروری است که برای تحقق اهداف و توسعه شایستگی‌های خود به منابع و مراجع غیرفارسی نیز مراجعه کنیم. در این راستا پودمان حاضر به همین منظور در کتاب دانش فنی تخصصی طراحی و تألیف شده است.

برقراری ارتباط بین افراد شاغل در رشته‌هایی که به دلیل ماهیت‌شان نیازمند به تبادل اطلاعات هستند، اهمیت ویژه‌ای بیش از سایر رشته‌ها دارد.

با توجه به گستردگی علوم و فنون دریایی، توسعه روزافزون حمل‌ونقل و تجارت دریایی، فراگیری زبان انگلیسی به صورت عمومی و تخصصی برای دریانوردان ضروری می‌باشد. در کنار این موارد حضور کارکنان با ملیت و زبان‌های مختلف و همچنین ارتباط شناورها با یکدیگر در هنگام عملیات راهبری و هدایت کشتی، تخلیه و بارگیری و نیاز به برقراری ارتباط با پرسنلی که به زبان‌های مختلف سخن می‌گویند، سبب شده که «سازمان بین‌المللی دریانوردی» زبان انگلیسی را به عنوان زبان استاندارد رشته‌های دریایی انتخاب و تصویب نماید.

با توجه به اهمیت موضوع، هنرجویان پس از آشنایی با اصطلاحات مهم این رشته‌ها در این پودمان قادر خواهند بود مفاهیم بیان شده را (چه به صورت نوشتار و چه به صورت گفتار) به درستی درک کرده و مفاهیم اولیه مورد نظر خود را به زبان انگلیسی بیان کنند.

بدیهی است هدف از ارائه این پودمان، تدریس زبان انگلیسی نمی‌باشد بلکه کسب مهم‌ترین اطلاعات فنی گذشته تخصصی، حرفه‌ای خود می‌باشد. از طریق خواندن منابع ذکر شده می‌توان به این هدف دست یافت. البته برای پشتیبانی این امر در کتاب همراه هنرجو، که خود نیز عملاً یک دانشنامه ویژه بیشتر به خواندن درست لغات، جملات و درک مطالب ارائه شده در کاتالوگ‌ها، بروشور و کتاب‌های راهنمای کاربردی تأکید دارد.

پودمان ذکر شده حاوی یک لوح فشرده (CD) آموزشی نیز می‌باشد. در این لوح مطالب ارائه شده در درس به زبان اصلی بیان می‌شود تا راهنمایی در خواندن و گفتار باشد.

پروژه پایانی

هر گروه درباره یکی از موضوعات تخصصی پودمان، یک سخنرانی ۱۰ دقیقه‌ای (به زبان انگلیسی) انجام داده و ۵ دقیقه نیز به پرسش و پاسخ کلاسی اختصاص یابد.

Unit 1

ELECTRICAL SAFETY

Before attempting any electrical work, there are some basic safety precautions you must keep in mind. The possible dangers arising from the misuse of electrical equipment are well known. Electric shock and fire can cause loss of life and damage to equipment.



Figure 1 - sign of danger

There are some Regulations to control construction, installation, operation and maintenance of electrical equipment so that danger is eliminated as far as possible. Minimum acceptable standards of safety are issued by various bodies including national governments, international governmental conventions, national and international standards association (e.g. BSS and IES), etc. Dangers are usually caused by accidents, neglects or safety violations.

Students must operate equipment in a safe manner and maintain it in a safe condition at all times. They should keep in mind an essential list of DO's and DONT's when working with electrical equipment.



Figure 2- use of proper devices

DO get to know the electrical system and equipment. Study laboratory instructions and shop diagrams to pinpoint the location of switches and protection devices. Write down this information in a notebook. Note the normal indications on switchboard instruments so that abnormal operations can be quickly detected.



Figure 3 - check of covers, doors and all bolts

DO operate equipment according to manufactures' recommendations.

DO maintain equipment according to manufacturers' recommendations or service manual maintenance procedures.

DO ensure that all guards, covers and doors are securely fitted and that all bolts and fixings are fitted and tight.

DO inform the teacher before shutting down equipment for operation.

DO switch off and lock off supplies, remove fuses, and display warning notices before removing covers of equipment for maintenance.

DO confirm that circuits are DEAD (by using a voltage tester) before touching conductors and terminals.

DON'T touch live conductors under any pretext.

DON'T touch rotating parts.

DON'T leave live conductor or rotating parts exposed.

DON'T overload equipment.

You should think of 'safety' at all times and so develop a safety conscious attitude. This may well save your life and lives of others. Most accidents occur due to a momentary loss of concentration or attempts to short-circuit standard safety procedures. DO NOT let this happen to you.

Electric shock

Nearly everyone has experienced an electric shock at some time. At best, it is an unpleasant experience, at worst, it is fatal. Anyone who has access to live electrical equipment must be fully aware of first aid and safety procedures related to electric shock as described in relevant safety

acts. Copies of these safety procedures should be displayed on board.



Figure 4- Electric shock

Electric shock is due to the flow of current through your body. This is often from hand to hand or from hand to foot. A shock current as low as 15mA AC or DC may be fatal. Obviously, the size of shock current is related to the applied voltage and your body resistance. Unfortunately, your body resistance goes down as the applied voltage goes up. This means that the shock current is further increased at high voltages. The size of your body resistance also depends on other factors such as your state of health, the degree of contact with live wires and the perspiration or dampness on your skin. Typical dry full contact body resistance is about 5000Ω at 25 V falling to about 2000Ω at 250V.

EXERCISES

A. Read each statement carefully and decide whether it is true or false. Write “T” for true statement and “F” for false ones.

- 1 In any electrical work, there are some basic safety precautions.
- 2 Electrical shock and fire can cause loss of life and damage to equipment.
- 3 With control and regulations, danger can be eliminated as far as possible.
- 4 Each student must operate equipment in a safe manner and maintain it in a safe condition at all times.
- 5 “Safety” should be thought of at all times. This may well save your life.
- 6 An electric shock at best is a fatal experience, at worst, it is unpleasant.
- 7 Electric shock is due to the flow of current through equipment.
- 8 Unfortunately, your body resistance goes down as the applied voltage goes up.

B. Match the items in column A with their appropriate equivalent in column B Insert a, b, c... in the parentheses provided.

| A | | B | |
|-----------|-----|-----------------------------------|--|
| 1 attempt | () | a The use of sth in the wrong way | |
| 2 misuse | () | b Try to do sth. | |
| 3 case | () | c c. reason | |
| 4 quickly | () | d discover | |
| 5 detect | () | d excessive use | |
| 6 abuse | () | e rapidly | |
| 7 neglect | () | f like | |
| 8 such as | () | d giving not enough care to | |

C. Definitions and word study:

- 1 Resistance: unit of ohms with the symbol of R. A device, component, or circuit, which has opposition to flow.
- 2 Semiconductor: A general name given to transistors, diodes, and similar devices that use semiconducting materials.
- 3 Short circuit: low resistance that bypasses the flow of current.
- 4 Component: small electronic parts.

Unit 2

RECTIFYING CIRCUITS

Although mains supplies are normally AC, for many applications a DC supply is required where it is uneconomical or impractical to use batteries. The mains AC supply must be converted into DC. We will examine here three rectifying circuits for converting single phase AC supplies into direct current. Figure 5 shows a half-wave rectifier. It incorporates a single diode. The direction of the arrow on the diode symbol indicates the conventional flow of current through the diode.

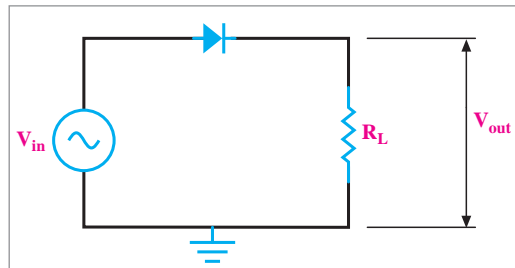


Figure 5- a half-wave rectifier

R_L is the resistance of the load and V_L the voltage across the load. An alternating current changes from positive to negative in each cycle. This cycle is repeated 50 or 60 times per second in most AC systems. The resultant waveform is sinusoidal.

Figure 6 shows what happens to the AC sine wave in half wave rectification. In the first half of each cycle, the applied voltage is positive and the diode conducts, allowing current to pass through the load. In the second half, the applied voltage is negative and is blocked by the high resistance of the diode to reverse voltage. Time form of rectification has only light current applications. It is not economical in that half the supply wave form is not utilized.

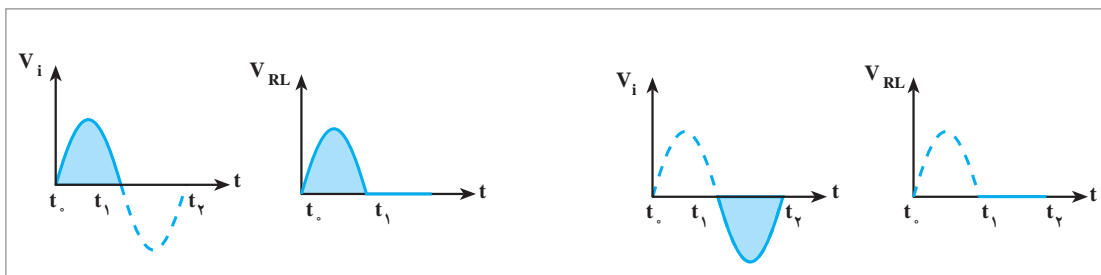


Figure 6- waveform of half-wave rectifier

The circuit in Figure 7 provides full-wave rectification. It requires a transformer with a center-tapped secondary and two diodes. The EMFs in both halves of the secondary are equal but are of opposite polarity at any instant. Thus when A is positive with respect to B, D1 conducts and the current passes through the load back to B. Similarly when C is positive with respect to B, D2 conducts. Only half the secondary winding time is utilized at any single time.

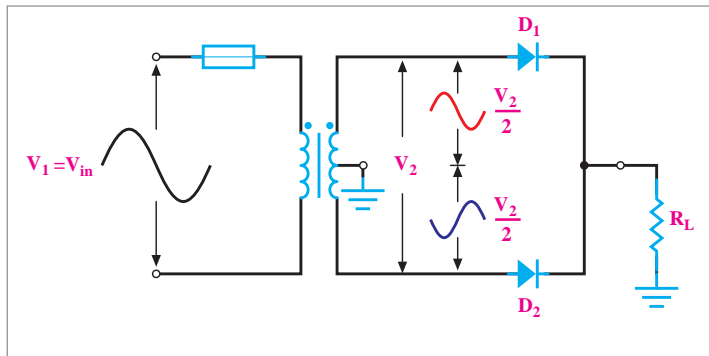


Figure 7- full-wave rectification transformer with a center-tapped secondary

The bridge circuit shown in Figure 8 contains four diodes wired as shown to form a bridge. This circuit also provides full-wave rectification but it is more efficient in that all the output of the secondary is utilized.

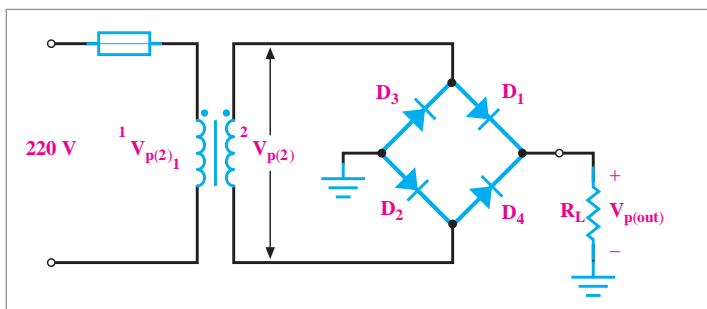


Figure 8- full-wave rectification

In addition, having four diodes, the peak inverse voltage which any single diode has to withstand is half that of the circuit shown in Figure 5-3. In the first half of any cycle, A is positive with respect to B and D2 and D4 conduct. D1 and D3 conduct in the second half of the cycle. Bridge circuits have many applications and are to be found in the power supplies of much mains operated electronic equipment. Another common use is in providing low-power DC motor drives.

EXERCISES

A. Read each statement carefully and decide whether it is true or false. Write «T» for true statements and «F» for false ones.

- 1 A half-wave rectifier incorporates a single diode.
- 2 An alternating current changes from positive to negative in each cycle.
- 3 A full-wave rectification requires a transformer with a centre-tapped secondary and two diodes.
- 4 The EMFs in both halves of the secondary are equal but are of opposite polarity at any instant.
- 5 Bridge circuits have no applications in the power supplies of much mains operated electronic equipment.

B. Match the items in column A with their appropriate equivalent in column B. Insert a, b, c, ... in the parentheses provided.

| | A | | B |
|---|---------------|---|----------------------|
| 1 | utilize () | a | moment |
| 2 | equipment () | b | usually; typically |
| 3 | normally () | c | device; apparatus |
| 4 | reverse () | d | use |
| 5 | instant () | e | contrary or opposite |

C. Word study and definitions:

- 1 Diode A two-element electronic device. The most common application is converting AC to DC Rectification.
- 2 Emitter One of the three legs of a bipolar transistor.
- 3 Collector One of the three leads of a bipolar transistor.
- 4 Direct Current (DC) Current that flows only in one direction. A battery Is a source of direct current.
- 5 Half-wave Rectification A single diode that converts AC to DC voltage.

Unit 3

MOTOR THEORY

The DC motor has two basic parts: the rotating part that is called the armature, and the stationary part that includes coils of wire called the field coils. The stationary part is also called the stator. Fig. 9 shows a picture of a typical DC motor.



Figure 9- A typical DC motor

Fig. 10 shows a picture of a DC armature, and Fig 11 shows a picture of a typical stator.



Figure 10 - Armature of a DC motor

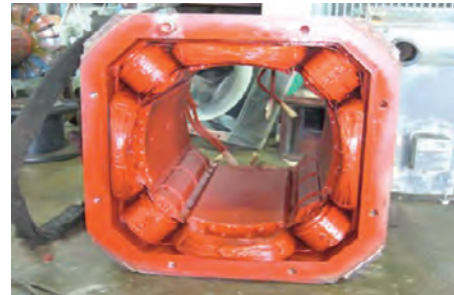


Figure 11- Stator of a DC motor

From the picture in Fig. 12 you can see the armature is made of coils of wire wrapped around the core, and the core has an extended shaft that rotates on bearings. You should also notice that the ends of each coil of wire on the armature are terminated along the end of the armature. As Figure shows the termination points are called the commutator, and this is where the brushes make electrical contact to bring electrical current from the stationary part to the rotating part of the machine.

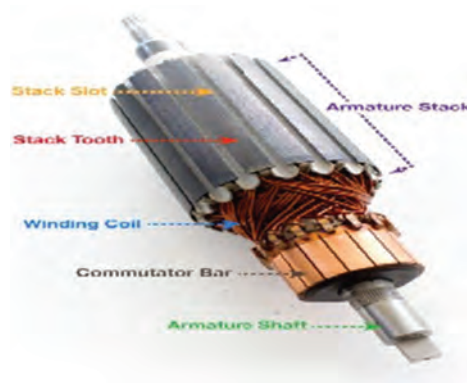


Figure 12 - Commutator DC Motor

It will be easier to understand the operation of the DC motor from a basic diagram that shows the magnetic interaction between the rotating armature and the stationary Held coils. Fig. 13 shows three diagrams that explain the DC motor's operation in terms of the magnetic interaction.

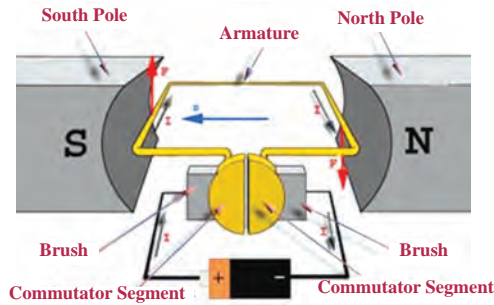


Figure 13- (a)

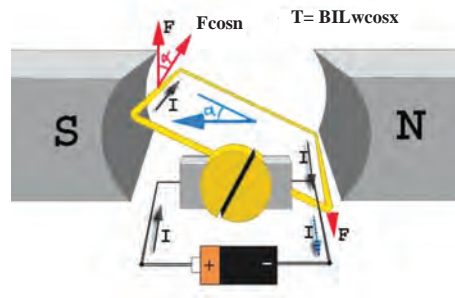


Figure 13- (b)

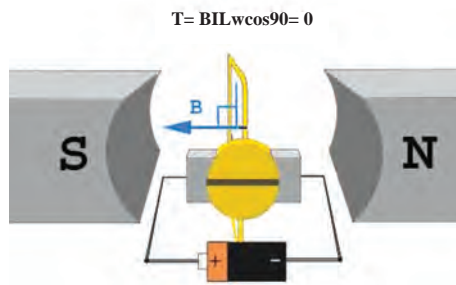


Figure 13- (c)

Figure 13- three diagrams of the DC motor's operation

Figure 13- (a) Magnetic diagram that explains the operation of a DC motor. The rotating magnet moves clockwise because like poles repel. (b) The rotating magnet is being attracted because the poles are unlike. (c) The rotating magnet is now shown as the armature coil, and its polarity is determined by the brushes and commutator segments.

In Figure 13 (b) you can see that a bar magnet has been mounted on a shaft so that it can spin. The field winding is one long coil of wire that has been separated into two sections. The top section is connected to the positive pole of the battery and the bottom section is connected to the negative pole of the battery. It is important to understand that the battery represents a source of voltage for this winding. In the actual industrial-type motor, this voltage will come from the DC voltage source for the motor. The current flow in this direction makes the top coil the north pole of the magnet and the bottom coil the south pole of the magnet.

The bar magnet represents the armature and the coil of wire represents the field. The arrow shows the direction of the armature's rotation. Notice that the arrow shows the armature starting to rotate in the clockwise direction. The north pole of the field coil is repelling the north pole of the armature, and the south pole of the field coil is repelling the south pole of the armature.

AC MOTORS

Today AC motors are more widely used in industrial applications than DC motors. They are available to operate on single-phase or three-phase supply voltage systems. This allows the motor control designer to choose the type of motor to fit the application. Most single-phase motors are less than 3 HP; although some larger ones are available, they are not as common. Three-phase motors are available up to several thousand horsepower, although most of the motors that you will be working with will be less than 50 HP.

The AC motor provides several advantages over DC motors. One advantage the AC motor has is that its design eliminates the need for brushes and commutators. The second advantage is that its rotating member is made of laminated steel rather than wire that is pressed on a core, which reduces maintenance. The AC motor does not need brushes and commutators since it creates the flux lines in its rotating member by induction. The induction process that is used to get the current into the rotating member is similar to the induction that occurs between the primary and secondary windings of a transformer. This is possible in an AC motor because supply voltage is sinusoidal.

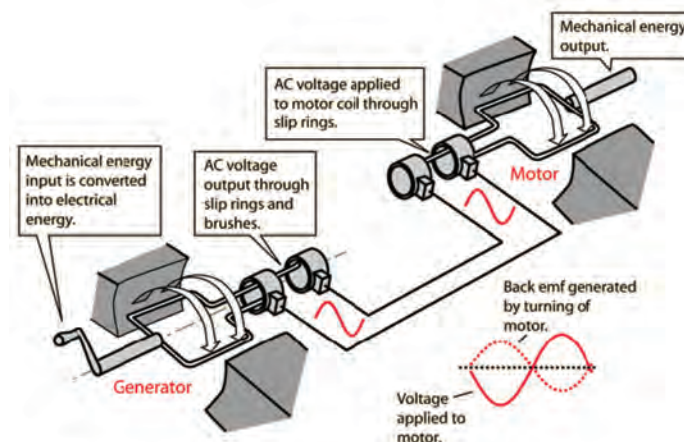


Figure 14 - Structure of AC motor

The rotating field in the AC motor is called the rotor, and the stationary field is called the stator. The design of the rotor is different from the rotating armature in the DC motor because it is made completely of laminated steel rather than having copper coils pressed on a laminated steel core. This allows the AC motor to operate longer than the DC motor with less periodic maintenance, which means that more AC motors are used in industry than DC motors. You need to be aware that the main reason DC motors were used in industry in the 1940s through the 1960s is that their speed could be controlled more easily than controlling the speed of AC motors. With the advent of variable-frequency drives, the speed of all AC motors can be adjusted more easily than DC motors, and the AC motor requires less maintenance since it does not have brushes.

EXERCISES

A. Read each statement carefully and decide whether it is true or false. Write «T» for true statements and «F» for false ones.

- 1..... The DC motor has two basic parts: the rotating part and stationary part.
- 2..... The three types of DC motors are the series-motor, the shunt motor and the compound motor.
- 3..... When laminated steel sections are pressed together to make the core the eddy-currents can flow from one laminated segment to another.
- 4..... The direction of rotation of a series motor can be changed by changing the polarity of either the armature or field winding.

B: Match the words in column «A» with their synonyms in column «B».

| | A | | B |
|---|---------------------|---|---|
| 1 | Stator () | a | Rotating part of the motor |
| 2 | Armature () | b | Squirrel cage induction |
| 3 | Induction Motor () | c | Revolutions per minute |
| 4 | R.P.M () | d | Stationary part of the motor |
| 5 | F.L.A () | e | Full load amperage |
| 6 | Commutator () | f | The magnetic current that circulate in core |
| 7 | Eddy current () | g | Magnetic losses |
| 8 | Flux losses () | h | The termination points |

C: Word study and definitions:

- 1 Magnetic The magnetic phono cartridge has a moving Vane between the coil assemblies. The output Voltage is very low and must have a Preamplifier stage ahead of it, unlike the Crystal cartridge.
- 2 Magnetic Field The force that surrounds the magnet and produces magnetic lines.
- 3 Stator Fixed plates in a variable capacitor.
- 4 Troubleshooting The method of determining the failure of An electrical or electronic breakdown.

Unit 4

GPS

People have been trying to find out a reliable way to tell where they are and to help guide them to where they are going. Cavemen probably used stones and twigs to mark a trail when they set out hunting for food. The earliest mariners followed the coast closely to keep from getting lost. When navigators first sailed into the open ocean, they discovered they could chart their course by following the stars. The ancient Phoenicians used the North Star to journey from Egypt and Crete. The next major developments in the quest for the perfect method of navigation were the magnetic compasses.

About 50 years ago, when the space technology was born, it was actually giving birth to an entirely new method of tracking and guiding, employing man made stars, now known as Satellite Navigation Systems and Global Positioning Systems are the latest of its outcome. The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. Global Positioning System consists of three interacting segments:

- The Space Segment -- satellites orbiting the earth
- The Control Segment -- the control and monitoring stations
- The User Segment -- the GPS signal receivers owned by users.

The space segment consists of a constellation of 24 active satellites orbiting the earth every 12 hours. There are six orbital planes (with nominally four SVs in each), equally spaced (60 degrees apart), and inclined at about fifty-five degrees with respect to the equatorial plane. Four satellites are located in each of six orbits. The orbits are distributed evenly around the earth. The satellites orbit at an altitude of about 20,200 km at a velocity of 26.61 km per second. Satellites are positioned so that we can receive signals from six of them nearly 100 percent of the time at any point on Earth.

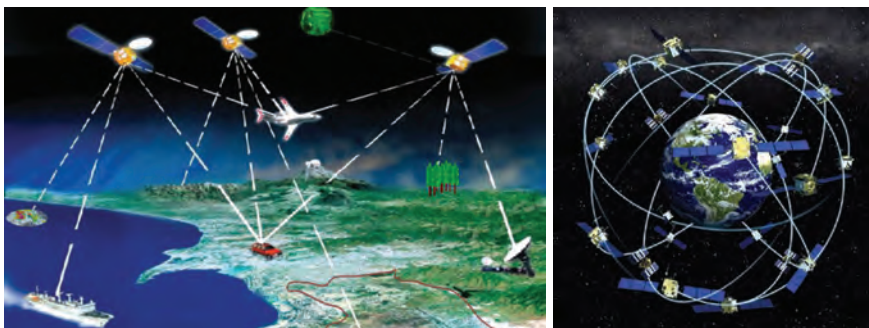


Figure 15 - The Earth Satellites Orbiting

يودمان ٥ : كسب اطلاعات فنى

You need that many signals to get the best position information. This constellation provides the user with between five to eight SVs visible from any point on the earth. These satellites are equipped with very precise clocks that keep accurate time to three nanoseconds. This precision timing is important because the receiver must know exactly how long it takes for its signal to get to each satellite and return. By knowing the exact amount of time the signal has taken to get back from each satellite, it can calculate its position.

The GPS control, or ground segment consists of unmanned monitor stations located around the world. These stations track and monitor the GPS satellites.

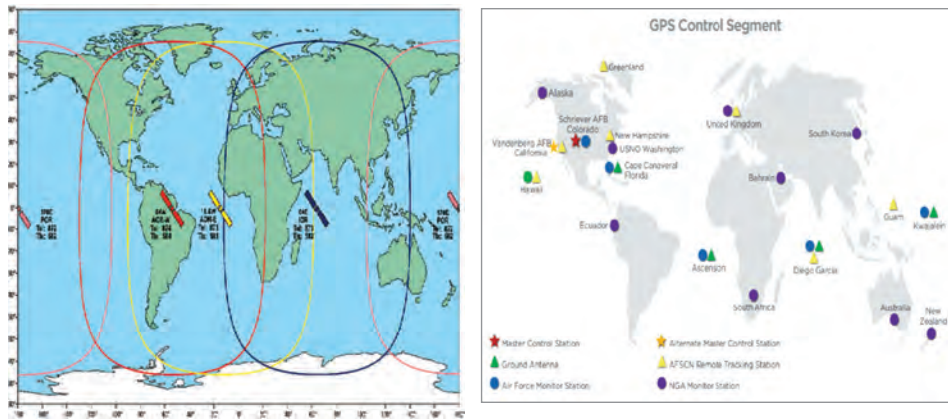


Figure 16- the control and monitoring stations

The Master Control station uploads orbital data and clock data to the satellites. The satellites then send subsets of the orbital data to GPS receivers over radio signals.

The GPS User Segment consists of the GPS receivers and the user community. GPS receivers convert satellites signals into position, velocity, and time estimates. Four satellites are required to compute the four dimensions of X, Y, Z (position) and Time. GPS receivers are used for navigation, positioning, time dissemination, and other research. Astronomical observatories, telecommunications facilities, and laboratory standards can be set to precise time signals or controlled to accurate frequencies by special purpose GPS receivers.



Figure 17- Usage

The satellites transmit two microwave carrier signals. The L1 frequency (1575,42 MHz) carries the navigation message and the SPS code signals. The L2 frequency (1227,60 MHz) is used to measure the ionospheric delay by PPS equipped receivers.

GPS has become important for nearly all military operations and weapons systems. They were carried by foot soldiers and attached to vehicles, helicopters, and aircraft instrument panels. GPS is also helping to save lives. Many police, fire, and emergency medical service units are using GPS receivers to determine the police car, fire truck, or ambulance nearest to an emergency, enabling the quickest possible response in life-or-death situations.

EXERCISES

A: Read each statement carefully and decide whether it is true or false. Write «T» for true statements and «F» for false ones.

- 1 There are six satellites in each orbital plane.
- 2 The orbital plane of each satellite is inclined at an angle of 55° to the plane of the equator.
- 3 In the time that the Earth takes to complete one revolution, each satellite makes two orbits around the Earth.
- 4 Global Positioning System consists of three interacting segments.
- 5 The accuracy of a position obtained by GPS is independent of the geometry of the satellites used.
- 6 We have to find out the relationship between the user's clock and the satellite's clock to measure the range between the satellite and the user.

B: Word study and definitions:

- 1 User segment : The component of the GPS system that include receivers.
- 2 Channel : A channel of a GPS receiver consists of the radio frequency, circuitry, and software necessary to tune the signal from a signal GPS satellite.
- 3 Data message : A 1500 bit message included in the GPS signal which reports the satellite's location, clock corrections, and health.
- 4 Ionospheric refraction : The change in the propagation speed of a signal as it passes through the ionosphere.

Unit 5

RADAR

Radar is an object-detection system that uses radio waves to determine the range, angle, or velocity of objects. It can be used to detect aircraft, ships, spacecraft, guided missiles, motor vehicles, weather formations, and terrain. A radar system consists of a transmitter producing electromagnetic waves in the radio or microwaves domain, a transmitting antenna, a receiving antenna (often the same antenna is used for transmitting and receiving) and a receiver and processor to determine properties of the object(s). Radio waves (pulsed or continuous) from the transmitter reflect off the object and return to the receiver, giving information about the object's location and speed.

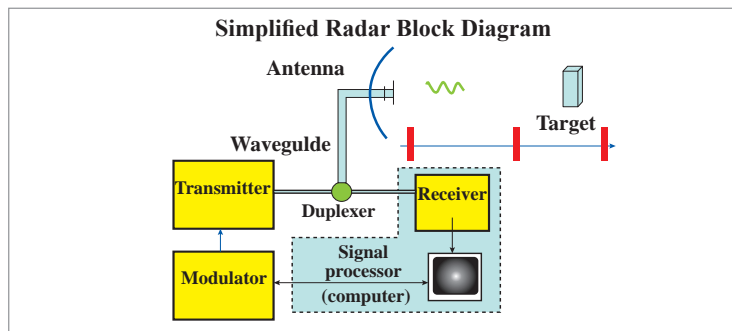


Figure 18– simplified radar block diagram

Radar was developed secretly for military use by several nations in the period before and during World War II. The term RADAR is an acronym for Radio Detection and Ranging or Radio Direction and Ranging. The term radar has since entered English and other languages as a common noun, losing all capitalization.

A practical radar system requires seven basic components as illustrated below:

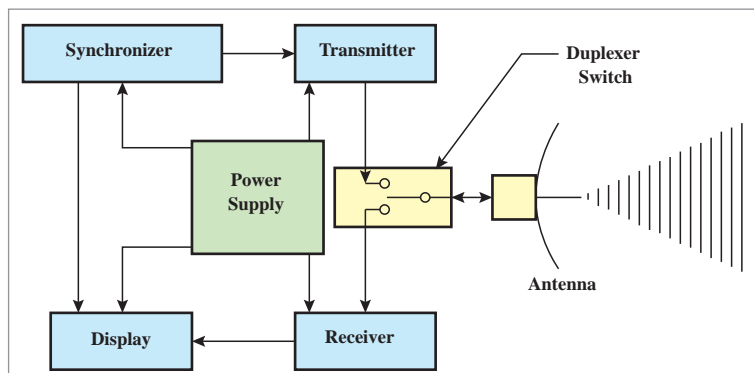


Figure 19– practical radar system

Transmitter: The transmitter creates the radio wave to be sent and modulates it to form the pulse train. The transmitter must also amplify the signal to a high power level to provide adequate range.

Receiver: The receiver is sensitive to the range of frequencies being transmitted and provides amplification of the returned signal. In order to provide the greatest range, the receiver must be very sensitive without introducing excessive noise.

Power Supply: The power supply provides the electrical power for all the components. The largest consumer of power is the transmitter which may require several kW of average power. The actual power transmitted in the pulse may be much greater than 1 kW. The power supply only needs to be able to provide the average amount of power consumed, not the high power level during the actual pulse transmission.

Duplexer: This is a switch which alternately connects the transmitter or receiver to the antenna. Its purpose is to protect the receiver from the high power output of the transmitter. During the transmission of an outgoing pulse, the duplexer will be aligned to the transmitter for the duration of the pulse, PW. After the pulse has been sent, the duplexer will align the antenna to the receiver. When the next pulse is sent, the duplexer will shift back to the transmitter. A duplexer is not required if the transmitted power is low.

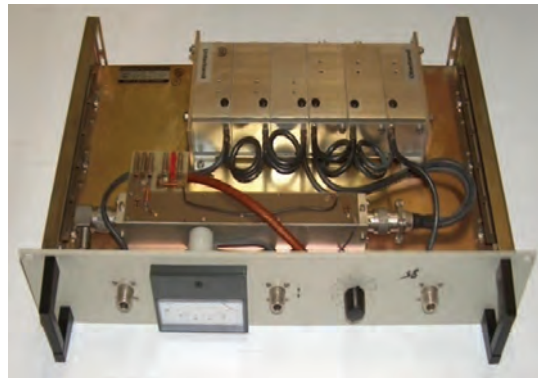
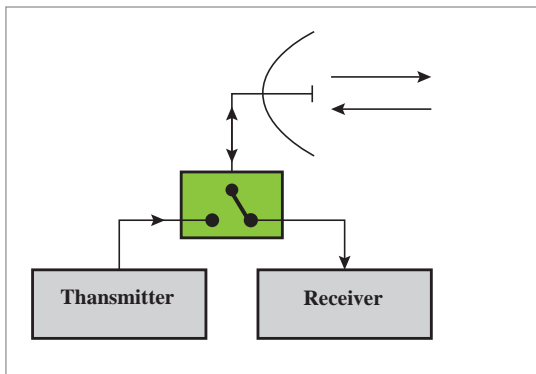


Figure 20– Duplexer (Tx/Rx switch)

Antenna: The antenna takes the radar pulse from the transmitter and puts it into the air. Furthermore, the antenna must focus the energy into a well-defined beam which increases the power and permits a determination of the direction of the target.



Figure 21– practicalAntenna

Display: The display unit may take a variety of forms but in general is designed to present the received information to an operator.



Figure 22– Display of Radar

A radar system has a transmitter that emits radio waves called radar signals in predetermined directions. When these come into contact with an object they are usually reflected or scattered in many directions. But some of them absorb and penetrate into the target to some degree. Radar signals are reflected especially well by materials of considerable electrical conductivity—especially by most metals, by seawater and by wet ground. The radar signals that are reflected back towards the transmitter are the desirable ones that make radar work. If the object is moving either toward or away from the transmitter, there is a slight equivalent change in the frequency of the radio waves, caused by the Doppler Effect.

Although the reflected radar signals captured by the receiving antenna are usually very weak, they can be strengthened by electronic amplifiers. The weak absorption of radio waves by the medium through which it passes is what enables radar sets to detect objects at relatively long ranges. Such weather phenomena as fog, clouds, rain, falling snow, and sleet that block visible light are usually transparent to radio waves. Certain radio frequencies that are absorbed or scattered by water vapor, raindrops, or atmospheric gases (especially oxygen) are avoided in designing radars, except when their detection is intended.

EXERCISES

A: Read each statement carefully and decide whether it is true or false. Write «T» for true statements and «F» for false ones.

- 1..... Another word for radio detection and ranging is radar.
- 2..... A radar is an instrument to determine the range and the direction of targets.
- 3..... A radar doesn't have a transmitter sending radio wave pulses.

4..... An antenna can server both for transmitting as well as for receiving.

5..... The duplexer makes it possible for the same antenna to be used for transmitting and receiving.

B: Match the items in column A with their appropriate equivalent in column B. Insert a, b, c, ... in the parentheses provided.

| | A | B |
|----|----------------|---|
| 1 | detection () | a. the return of a signal after it has been reflected |
| 2 | echo () | b. discovering or locating an object |
| 3 | curious () | c. rule; basic |
| 4 | principle () | d. eager |
| 5 | as well as () | e. and |
| 6 | since () | f. because; due to |
| 7 | that is () | g. namely; which is to say |
| 8 | common () | h. normal; usual |
| 9 | adjust () | i .regulate |
| 10 | appear () | j. become visible; be seen |

C: Word study and definitions:

| | |
|----------------------------------|--|
| 1 Duplexer: | A device to isolate the transmitter from the receiver during radar operation |
| 2 Indicator: | A device to show a desired kind of information |
| 3 Plan-Position Indicator (PPI): | An instrument used in radar directly to indicate the range and direction of a target |
| 4 Range: | The distance between the instrument and a target or the distance capability of a radar |
| 5 Target: | The object whose position is to be determined |

Unit 6

HOW RADIO WORKS

Radio Waves:

Radio transmitters work by supplying a rapidly changing electrical current to an aerial (antenna), to create a changing electromagnetic field. The speed at which these currents change controls the speed at which the electromagnetic field around the aerial changes. This is measured in hertz (Hz).

1Hz 1 hertz 1 cycle per second

1 kHz 1 kilohertz 1 thousand cycles per second

1MHz 1 megahertz 1 million cycles per second

1GHz 1 gigahertz 1 billion cycles per second

Consider the image of a pebble dropped into a pond, with the pebble representing the transmitter. The radiating ripples represent the fluctuating electromagnetic fields. These fields are called radio waves, and they radiate out from the aerial at the speed of light. Marine VHF radio operates at a frequency of approximately 156MHz, while MF/HF (single sideband or SSB) radios operate at frequencies from about 2MHz to 22MHz. The different frequencies have different characteristics for specific purposes, and are subdivided into bands:

Frequency range Band classification

10–30 kHz Very low frequency VLF

30–300 kHz Low frequency LF

300–3000 kHz (3MHz) Medium frequency MF

3–30 MHz High frequency HF

30–300 MHz Very high frequency VHF

300–3000 MHz (3GHz) Ultra-high frequency UHF

3GHz–30GHz Super-high frequency SHF.

Receiving Messages

It is frequently necessary to know how well the other station is receiving you, especially when the point in continuing to transmit if the other station can hardly hear you, or make out your message. Equally, you may need to inform the other station that you can hear him only with difficulty. Ability to make out the message is called readability, from the verb to read, meaning

«to receive sufficiently well to make out the message». Information about the readability of a signal is reported by a simple code of numbers from 0 (unusable) to 5 (excellent). The overall readability of the received transmission is reported by use of the Readability Code:

One = unusable

Two = poor

Three = fair

Four = good

Five = excellent

Example:

- «How do you read me?»

- «I read you three.»



Figure 23– Practical Radio

Making Contact

An initial call is the transmission by which a station starts or re-establishes an exchange.

1 Address

This is the identification of the station being called and will normally consist of one or more of the following:

a. name

⇒ not more than three times

b. call sign

If the name or call sign are not known, the address will consist of one or more of the following, given in order of effectiveness, and preceded by the phrase ...« All ships ... calling unknown ship ...»

c. ship description

d. position

e. course and speed

The address is to be repeated once when making the initial call. It is not necessary to repeat it when addressing at other stages of the exchange.

2 Identify

This is the identification of the station making the call, preceded by the phrase → «This is ...»

It will normally consist of name and call sign, ship description, position, course and speed. The identification is to be repeated once when making the initial call.

3 State VHF channel on which call is being made. This must be included in the initial call as most ships and shore stations listen to more than on VHF channel at the same time. e.g. ⇒
- «On VHF channel one-six.»

4 Over

The word «over» is to be used whenever a transmission is finished and a reply expected. It indicates to the other stations that you have finished talking and are about to release the transmit switch, thus making it possible for him to reply. Example of an initial call:

{ Rose Maru, Juliette Alfa Alfa Alfa.
Rose Maru, Juliette Alfa Alfa Alfa.
This is Rattler, Golf xray xray xray;
Rattler, Golf xray xray xray;
On VHF channel one-six.
Over.

To respond to call, the same procedure should be followed. e.g.

{ Rattle, Golf Xray Xray Xray.
This is Rose Mary, Juliette Alfa Alfa Alfa.
Over.

Agree or Disagree with VHF channel:

If possible the other station must agree with the controlling station's choice of working VHF channel. If it is not possible to agree, the other station must then make a disagree VHF channel transmission. If the controlling station neglects to state the working VHF channel, the other station must then make and ask VHF channel transmission.

Example:

- Rattler. This is Rose Maru. Agree VHF channel zero-six. Over.
- Rattler. This is Rose Maru. VHF channel zero- six unable. VHF channels available are zero-eight through one-zero, and seven-zero. Over.

Question:

- Rattler. This is Rose Maru. Which VHF channel?
Over.



Figure 24– VHF Channel Radio

When to Use Distress, Urgency and Safety Procedure:

1 Distress

When a ship or an aircraft is threatened by grave and imminent danger, and request immediate assistance, must use the word «Mayday» as a prefix of her message. Example:

Mayday Mayday Mayday. This is Rattler Rattler Rattler. Rattler Xray Xray Xray. My position is five-zero degrees three-zero minutes North, zero-three-nine degrees two-zero minutes West. I have collided with an iceberg. I am sinking. I require immediate assistance. Over.



Figure 25– Radio Room

2 Urgency

This type of procedure is used when a station has to transmit a message concerning the safety of a ship, an aircraft, or other vessels, or the safety of a person. Example:

Pan-Pan Pan-Pan Pan-Pan. This is Vega Vega Vega, Pan-Pan Vega seven Victor Alfa Tango. My Position is Zero-nine-zero degrees true, from Ras Sarkan, one-five miles. I have lost my propeller. I require tow. Over.

Safety (say-cure-e-tay)

This is the transmission by which the station sending it has a message to transmit an important navigational or meteorological warning. The transmission will be prefaced with the safety marker «securite» pronounced say-cure-e-tay. It must be conducted on a working VHF channel unless it is impossible to do so. This message is only to be made with the authorization of the Master or person responsible for the ship or aircraft. Example:

Securite Securite Securite. All ships. This is Arcadia Arcadia Arcadia. Securite. Arcadia, Charlie Alfa AlfaAlfa. Deca warning. Switch to VHF channel zero-six. Over.

EXERCISES

A: Read each statement carefully and decide whether it is true or false. Write «T» for true statements and «F» for false ones.

- 1 ... Electromagnetic fields are called sound waves.
- 2 ... Ability to make out the message is called readability.
- 3 ... The word «over» is to be used whenever a transmission is finished and a reply expected.
- 4 In urgency messages we must use the word «Mayday» as a prefix of his message.
- 5 Safety messages must be conducted on a working HF channel.

B. Match the items in column A with their appropriate equivalent in column B . Insert a, b, c, ... in the parentheses provided.

| | A | | B |
|---|----------|-----|---------------------------|
| 1 | function | () | a play a great role |
| 2 | besides | () | b surrounding |
| 3 | course | () | c if |
| 4 | whether | () | d not moving ; stationary |
| 5 | fixed | () | e in addition to |
| 6 | vicinity | () | f direction |
| 7 | special | () | g particular |

C: Word study and definitions:

| | |
|------------|---|
| Frequency | The number of recurring alternations in an electrical wave, such as AC, radio waves, etc. |
| hertz (Hz) | Cycles per second (cps), the unit of frequency. |
| noise | Any unwanted signal that is unrelated to the desired signal. |
| UHF | Ultra-high-frequency radio and TV frequencies above 300 MHz. |

ارزشیابی مرحله ای کسب اطلاعات فنی

| نمره | استاندارد (شاخص ها، داوری، نمره دهی) | نتایج ممکن | استاندارد عملکرد (کیفیت) | تکالیف عملکردی (شایستگی ها) | عنوان پودمان فصل |
|------|--|--------------------------|---|--------------------------------|--------------------------|
| ۳ | <p>۱- کاربرد اصطلاحات تخصصی را بداند.</p> <p>۲- توانایی نقشه خوانی، کاتالوگ خوانی و استفاده از برگه اطلاعات را داشته باشد.</p> <p>۳- توانایی استخراج و کسب اطلاعات از منابع به روز را داشته باشد.</p> <p>* هنرجو توانایی انجام همه شاخص ها را داشته باشد.</p> | بالاتر از حد انتظار | | | |
| ۲ | <p>۱- کاربرد اصطلاحات تخصصی را بداند.</p> <p>۲- توانایی نقشه خوانی، کاتالوگ خوانی و استفاده از برگه اطلاعات را داشته باشد.</p> <p>۳- توانایی استخراج و کسب اطلاعات از منابع به روز را داشته باشد.</p> <p>* هنرجو توانایی انجام دو مورد از شاخص ها را داشته باشد.</p> | در حد انتظار | به کارگیری اطلاعات فنی در حوزه تخصصی | توانایی کسب اطلاعات فنی | کسب اطلاعات فنی |
| ۱ | <p>۱- کاربرد اصطلاحات تخصصی را بداند.</p> <p>۲- توانایی نقشه خوانی، کاتالوگ خوانی و استفاده از برگه اطلاعات را داشته باشد.</p> <p>۳- توانایی استخراج و کسب اطلاعات از منابع به روز را داشته باشد.</p> <p>* هنرجو توانایی انجام یک مورد از شاخص ها را داشته باشد.</p> | پایین تر از حد انتظار | | | |
| | | | | | نمره مستمر از ۵ |
| | | | | | نمره شایستگی پودمان از ۳ |
| | | | | | نمره پودمان از ۲۰ |

ارزشیابی شایستگی کسب اطلاعات فنی

| <p>شرح کار:</p> <ul style="list-style-type: none"> - پاسخگویی به کلیه فعالیت‌های پودمان - شرکت در بحث‌های کلاسی - ارائه سخنرانی با موضوع دلخواه <p>استاندارد عملکرد:</p> <p>به‌کارگیری اطلاعات فنی در حوزه تخصصی</p> <p>شاخص‌ها:</p> <p>توانایی خواندن، نوشتن و بیان اطلاعات فنی</p> | | | |
|--|---|-----------------------|------------|
| <p>شرایط انجام کار، ابزار و تجهیزات:</p> <p>شرایط: کلاس درس مجهز به پرده‌نگار باشد.</p> <p>ابزار و تجهیزات: در کلاس امکان نمایش فایل‌های صوتی و تصویری وجود داشته باشد.</p> | | | |
| <p>معیار شایستگی:</p> | | | |
| ردیف | مرحله کار | حداقل نمره قبولی از ۳ | نمره هنرجو |
| ۱ | توانایی کاربرد اصطلاحات تخصصی | ۲ | |
| ۲ | توانایی استخراج و بیان اطلاعات فنی از منابع مختلف | ۱ | |
| | <p>شایستگی‌های غیر فنی، ایمنی، بهداشتی، توجهات زیست‌محیطی</p> <p>۱- رعایت نکات ایمنی دستگاه‌ها</p> <p>۲- دقت و تمرکز در اجرای کار</p> <p>۳- شایستگی تفکر و یادگیری مادام‌العمر</p> <p>۴- اخلاق حرفه‌ای</p> | ۲ | |
| | میانگین نمرات | | * |

* حداقل میانگین نمرات هنرجو برای قبولی و کسب شایستگی (۲) می‌باشد.

- ۱ ماشین‌های الکتریکی DC، امیرحسین ترکمانی. دفتر تألیف کتاب‌های درسی فنی و حرفه‌ای و کاردانش، ۱۳۹۲.
- ۲ ماشین‌های الکتریکی AC، محمد علی مددی. دفتر تألیف کتاب‌های درسی فنی و حرفه‌ای و کاردانش، ۱۳۹۲.
- ۲ مدارهای الکتریکی، علی عراقی، فریدون علمی. دفتر تألیف کتاب‌های درسی فنی و حرفه‌ای و کاردانش، ۱۳۹۲.
- ۴ مبانی مخابرات و رادیو، سید محمود صموتی، یدالله رضازاده، شهرام نصیری سواد کوهی و محمود شبانی، ۱۳۹۱.
- ۵ الکترونیک عمومی، سید محمود صموتی، شهرام نصیری سواد کوهی، ۱۳۹۱.
- ۶ برنامه درسی رشته الکترونیک و مخابرات دریایی. (۱۳۹۳). سازمان پژوهش و برنامه‌ریزی آموزشی، دفتر تألیف کتاب‌های درسی فنی و حرفه‌ای و کاردانش.
- ۷ استاندارد شایستگی حرفه رشته الکترونیک و مخابرات دریایی. (۱۳۹۲). سازمان پژوهش و برنامه‌ریزی آموزشی، دفتر تألیف کتاب‌های درسی فنی و حرفه‌ای و کاردانش.
- ۸ استاندارد ارزشیابی حرفه رشته الکترونیک و مخابرات دریایی. (۱۳۹۲). سازمان پژوهش و برنامه‌ریزی آموزشی، دفتر تألیف کتاب‌های درسی فنی و حرفه‌ای و کاردانش.
- ۹ شیوه نامه نحوه ارزشیابی دروس شایستگی‌های فنی و غیرفنی شاخه‌های فنی و حرفه‌ای
- ۱۰ برنامه درسی جمهوری اسلامی ایران، ۱۳۹۱.

ارگان‌ها و مؤسساتی که در فرایند اعتبارسنجی این کتاب مشارکت داشته‌اند:

- ۱ اداره کل امور دریایی و سازمان‌های تخصصی بین‌المللی سازمان بنادر و دریانوردی؛
- ۲ مؤسسه آموزشی کشتیرانی جمهوری اسلامی ایران؛
- ۲ نیروی دریایی راهبردی ارتش جمهوری اسلامی ایران؛
- ۴ نیروی دریایی سپاه پاسداران انقلاب اسلامی ایران؛
- ۵ مرزبانی نیروی انتظامی جمهوری اسلامی ایران؛
- ۶ دبیرخانه کشوری هنرستان‌های علوم و فنون دریایی.

