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KỸ THUẬT ĐIỆN

Tập 1

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ENGLISH

FOR

ELECTRICAL ENGINEERING

Cố vấn chương trình : **Nguyễn Quốc Hùng, M.A**

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CONTENTS

INTRODUCTION

1. The authors

The course is designed by two teachers of English at Hanoi University of technology, Ms. Tran Huong Giang and Ms. Nguyen Thi Bac. They both have Masters Degree in English language. They have a lot of experience in teaching English in general and English for Specific Purposes (ESP) in particualar. They also have experience in designing materials for different courses.

2. The course

English for Electrical Engineering is a course on English for Specific Purposes (ESP) designed to develop the English skills and basic knowledge in electronics for technical students and engineers who work in the field. This textbook is intended for learners who begin to take the course of English in electronics. The most important aim of the course is to help students develop the ability to deal with the concepts used in technical texts.

The book consists of ten units which can be completed in twenty 45 minute class hours. The units are organized around the various topics used in electronics field. The skills are introduced as they relate to the topic. Each unit in the book is divided into different sections:

Vocabulary and Pronunciation: This consists of three exercises which provide new terms related to the topic.

Reading: There are two or three exercises in this part which contain comprehension questions to help students understand the reading text better.

Language Focus: This sections introduces theory and practice on certain grammatical or vocabulary feature.

Listening: This part provides exercises to improve students' listening skills.

Although we hope that you will enjoy working through this textbook, we do not expect you find it easy. If you have any questions regarding the course, please do not be hesitating to contact us. We are always happy to share with you our expertise and experience of studying this subject.

Business English Academy

TABLE OF CONTENT

Electromagnetic induction	Pronunciation	and Vietnamese translations **Exercise 2** **T.S 1** Listen and practise **Exercise 3** **T.S 2** Listen and complete the sentences by selecting the correct word from the box to fill in the gap
	reading	**Exercise 4** Fill in each gap with one suitable word **Exercise 5** Read the text in **Exercise 4** again and decide whether the statements are true (T) or false (F)
	Language work	**Exercise 6** Complete the sentences by finding the missing letters
Unit 4 Transformers	Vocabulary and Pronunciation	**Exercise 1** Match English terms and Vietnamese translations **Exercise 2** **T.S 1** Listen and practise **Exercise 3** **T.S 2** Listen and complete the sentences by selecting the correct word from the box to fill in the gap
	Listening	**Exercise 4** **T.S 3** Listen and decide whether the following sentences are true (T) or false (F)
	reading	**Exercise 5** Read the following passage carefully and choose the right kind of energy loss in a transformer according to the description.
	Language work	**Exercise 6** Complete the sentences by finding the missing letters
Unit 5 Electricity generation	Vocabulary and Pronunciation	**Exercise 1** Match English terms and Vietnamese translations **Exercise 2** **T.S 1** Listen and practise **Exercise 3** **T.S 2** Listen and complete the sentences by selecting

		the correct word from the box to fill in the gap
	listening	**Exercise 4** **T.S 3** Listen to the following passage and write down the missing words
	reading	**Exercise 5** Read the following passage and choose a suitable word from the box to fill in the gap
	Language work	**Exercise 6** Complete the sentences by finding the missing letters
Unit 6 Electric Motors	Vocabulary and Pronunciation	**Exercise 1** Match English terms and Vietnamese translations **Exercise 2** **T.S 1** Listen and practise **Exercise 3** **T.S 2** Listen and complete the sentences by selecting the correct word from the box to fill in the gap
	reading:	**Exercise 4** Read the passage carefully and decide whether the statements are true (T) or false (F) **Exercise 5** Choose a correct word to fill in the gap
	Language work	**Exercise 6** Complete the sentences by finding the missing letters
Unit 7 Batteries	Vocabulary and Pronunciation	**Exercise 1** Match English terms and Vietnamese translations **Exercise 2** **T.S 1** Listen and practise **Exercise 3** **T.S 2** Listen and complete the sentences by selecting the correct word from the box to fill in the gap
	Reading	**Exercise 4**: Are these sentences true (T) or false (F)?
	listening	**Exercise 5** Listen to T.S3 and fill in the blanks with the words given

	Language work	**Exercise 6** Match a line in A with a line in B to make meaningful sentences. **Exercise 7** Change the following sentences into passive
Unit 8 Incandescent light bulb	Vocabulary and Pronunciation	**Exercise 1** Match English terms and Vietnamese translations **Exercise 2 T.S 1** Listen and practise **Exercise 3 T.S 2** Listen and complete the sentences by selecting the correct word from the box to fill in the gap
	listening	**Exercise 4** Listen to T.S**3** and fill in the blanks with the words given
	Reading	**Exercise 5** Match each on the left with its name on the right **Exercise 6**: Are the following sententences true (T) or false (F)?
	Language work: Noun phrase (**1**)	**Exercise 7** Convert each of the following clauses into a noun phrase **Exercise 8** Translate the noun phrase into Vietnamese
Unit 9 Circuit breaker	Vocabulary and Pronunciation	**Exercise 1** Match English terms and Vietnamese translations **Exercise 2 T.S 1** Listen and practise **Exercise 3 T.S 2** Listen and complete the sentences by selecting the correct word from the box to fill in the gap
	Listening	**Exercise 4** Listen to T.S**3** and fill in the blanks with the words given
	reading	**Exercise 5**: Are the following sentences true (T) or false (F)?

	Language work: Noun phrase (**2**)	**Exercise 6** Now convert each of the following clauses into a noun phrase **Exercise 7** Translate the noun phrases into Vietnamese
Unit 10 Rectifier	Vocabulary and Pronunciation	**Exercise 1** Match English terms and Vietnamese translations **Exercise 2 T.S 1** Listen and practise **Exercise 3 T.S 2** Listen and complete the sentences by selecting the correct word from the box to fill in the gap
	listening:	**Exercise 4** Listen to T.S**3** and fill in the blanks with the words given
	Reading	**Exercise 5** Are the following sentences true (T) or false (F)?
	Language work: Noun phrase (**3**)	**Exercise 6** Now convert each of the following clauses into a noun phrase **Exercise 7** Translate the noun phrase into Vietnamese

UNIT 1 MAGNETISM

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. attractive or repulsive force	Hiện tượng từ tính
2. magnetic properties	Cực từ
3. lodestone	Nam châm
4. magnets	Các cực giống nhau
5. Magnetism	La bàn
6. magnetic field	Xoay
7. magnetic poles	Cuộn cảm
8. compass	Nam châm điện
9. turn	Đá nam châm
10.Like poles	Tính chất từ
11.Electromagnets	Từ trường
12.solenoids	Lực hút hoặc lực đẩy

Exercise 2 T.S 1 Listen and practise

1.attractive or repulsive force	5. Magnetism	9. turn
2. magnetic properties	6. magnetic field	10.Like poles
3. lodestone	7. magnetic poles	11.Electromagnets
4. magnets	8. compass	12.solenoids

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

attractive or repulsive force	magnets	solenoids
magnetic field	lodestone	turn
magnetic properties	Magnetism	magnetic poles
Electromagnets	compass	Like poles

1. Most common objects that are attracted to ……..contain iron or steel.
2. The ends of a magnet are called …….
3. The effect of ……on global warming has not yet been researched.
4. The …….of materials are in large part determined by the nature and magnitude of the atomic magnetic moments.
5. A …….could be used to show the locations of the poles on the Earth.

LISTENING

Exercise 4 T.S 3 Listen and decide whether the following sentences are true(T) or false (F)

1. In fact all materials are affected by a magnetic field at the same degree.
2. Magnets attract all magnetic objects.
3. The area around a magnet is called a magnetic field.
4. Magnetic poles are the ends of a magnet.
5. All magnet bars have two poles, north and south.

Exercise 5: T.S 4 Listen and choose a correct word from the box the fill in the gap

magnetic field	toward	repel	two
electromagnets	voltage	compass	electricity

Like poles of two magnets always push away, or……(1), each other. Different poles attract each other. For example, if the south pole of one magnet is put near the south pole of another magnet, the magnets will push away from each other. This will also happen with …….. (2) north poles. But if a north pole is put near a south pole, the magnets will move …… (3) each other until they stick together.

Magnets have many uses. One use was discovered long ago when explorers found out a magnet could be used as a …… (4) to show the locations of the poles on the Earth.

Electromagnets are another kind of magnet that only work when ……..(5) is running through them. Often, these magnets function using a coil of wire that creates a ……..……. (6) when there is a current through it. In addition to this coil of wire, a large piece of metal, generally iron, is placed inside the coil to greatly strengthen the magnetic field produced. Though most large ……..(7) employ many solenoids to lift heavy objects, smaller solenoids are used in everyday electronics, for example to change a …….. (8) in a transformer.

LANGUAGE WORK

Exercise 6 Complete the sentences by finding the missing letters

1. Many magnetic properties of materials are expressed in terms of the magnetic field s……..h.
2. L……e refers to A piece of intensely magnetic magnetite that was used as an early form of magnetic compass.
3. Until 1821, only one kind of m……..m was known, the one produced by iron magnets.
4. The two ends, which are the regions of concentrated lines of force, are called the p…….s of the magnet.
5. A c……s is a navigational instrument for finding directions on the Earth.
6. AC e……s can be used to demagnetize objects (like TV screens, audio tapes, VCR tapes) or to hold objects.
7. In physics, the term s……..d refers to a loop of wire, often wrapped around a metallic core, which produces a magnetic field when an electric current is passed through it.

UNIT 2 ELECTROMAGNETIC FIELD

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. electromagnetic field	Vùng lân cận
2. electrically charged object	Vật thể tích điện
3. vicinity	Trường điện từ
4. electromagnetic interaction	Tương tác điện từ
5. stationary charges	điện tích chuyển động
6. moving charges	Bức xạ
7. wavelike	điện tích tĩnh
8. quantum mechanical	Giống sóng
9. radiation	Thuật chụp Rơn ghen, chụp X quang
10.radio astronomy	Cơ lượng tử
11.radiography	Phép đo phóng xạ
12.radiometry	Bộ đọc mã vạch
13.laser therapy	Thiên văn học vô tuyến
14.laser-guided bomb	Kết nối/ tách rời
15.barcode reader	Bom dẫn đường bằng la de
16.engage / disengage	Liệu pháp la de

Exercise 2 T.S 1 Listen and practise

1. electromagnetic field	7. wavelike	13. laser therapy
2. electrically charged object	8. quantum mechanical	14. photomedicine
3. vicinity	9. radiation	15. laser-guided bomb
4. electromagnetic interaction	10. radio astronomy	16. barcode reader
5. stationary charges	11. radiography	17. engage / disengage
6. moving charges	12. radiometry	

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

electromagnetic field	charges	radiography
electrically charged object	wavelike	radiometry
vicinity	quantum	Laser therapy
electromagnetic interaction	radiation	photomedicine
barcode reader	laser-guided bomb	

1. The potential effects of ……..on human health vary widely depending on the frequency and intensity of the fields.

2. In the photoelectric effect - the emission of electrons from metallic surfaces by electromagnetic radiation - it is found that increasing the intensity of the incident radiation has no effect, and that only the frequency of the ……is relevant in ejecting electrons.

3. This ……picture of the electromagnetic field has proved very successful.

4. The electromagnetic field may be viewed as a dynamic entity that causes other …… and currents to move.

5. Oscillating charges produce electric and magnetic fields that may be viewed in a 'smooth', continuous, ……manner.

LISTENING

Exercise 4 T.S 3 Listen and decide whether the statements are true (T) or false (F)

1. The electromagnetic field is produced by electrically charged objects.

2. The electromagnetic field has a very limited field.

3. The electromagnetic field is made up of electric field and magnetic field.

4. The magnetic field is produced by currents.

5. Traditionally, the electromagnetic field is considered as a smooth, continuous field, propagated in a wavelike manner.

READING

Applications of electromagnetic field

Exercise 5: Choose a correct word from the box to fill in the gap

laser-guided bombs	simple	example	electromagnetic field
disengage	applied	created	electromagnetic radiation

Properties of the ……(1) are exploited in many areas of industry. The use of electromagnetic radiation is seen in various disciplines. For example, X-rays are high frequency ……(2) and are used in radio astronomy, radiography in medicine and radiometry in telecommunications. Other medical applications include laser therapy, which is an ……(3) of photomedicine. Applications of lasers are found in military devices such as ……(4) , as well as more down to earth devices such as barcode readers and CD players. Something as ……(5) as a relay in any electrical device uses an electromagnetic field to engage or to ……(6) the two different states of output (ie, when electricity is not……(7) , the metal strip will connect output A and B, but if electricity is applied, an electromagnetic field will be ……(8) and the metal strip will connect output A and C).

LANGUAGE WORK

Exercise 6 Complete the sentences by finding the missing letters

1. An electromagnetic field, sometimes referred to as an EM field, is generated when charged particles, such as electrons, are a……d.
2. The rotating s……y charge distribution creates a magnetic field.
3. Process of transmitting energy through space is known as r……n.
4. A branch of astronomy which studies c……..l objects and astrophysical phenomena is known as radio astronomy.
5. In optics, r……y is the field that studies the measurement of electromagnetic radiation, including visible light.
6. R……y is the use of X-rays to view unseen or hard-to-image objects.
7. P……e is an interdisciplinary branch of medicine that involves the study and application of light with respect to health and disease
8. A l……r-guided bomb (LGB) is a precision-guided munition (PGM) that uses semi-active laser homing to strike a designated target with greater accuracy than a free-fall bomb.

UNIT 3 ELECTROMAGNETIC INDUCTION

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. Electromagnetic induction	Cảm ứng điện từ
2. permanent magnet	Nam châm vĩnh cửu
3. induced electromotive force	Suất điện động cảm ứng
4. self-induction	Hiện tượng tự cảm
5. mutual induction.	Hiện tượng hỗ cảm
6. closed circuit	Mạch kín
7. magnetic flux	Từ thông
8. strength	Cường độ
9. induction motor	Động cơ cảm ứng
10.generator	Máy phát
11.stationary magnetic field	Từ trường tĩnh
12.rate	Tốc độ
13.turns of wire	Vòng dây

Exercise 2 T.S 1 Listen and practise

1. permanent magnet	6.Electromagnetic induction	10. strength
2. self-induction	7. mutual induction	11. closed circuit
3. magnetic flux	8. induced electromotive force	12. induction motor
4. generator	9. stationary magnetic field	13. rate
5. turns of wire		

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

Electromagnetic induction	self-induction	magnetic flux
induced electromotive force	mutual induction	induction motor
stationary magnetic field	closed circuit	generator
permanent magnet	turns of wire	strength

1. An electromotive force is induced in a circuit by varying the …….. linked with the circuit.
2. The most common use of …… is in the electric generator.
3. The induced electromotive force or EMF in any …… is equal to the time rate of change of the magnetic flux through the circuit.
4. When a ……. is moved relative to a conductor, or vice versa, an electromotive force is created.
5. Lenz's law, formulated by Estonian physicist Heinrich Lenz in 1834, gives the direction of the ……. and current resulting from electromagnetic induction.

READING

Exercise 4 Fill in each gap with one suitable word

Electromagnetic induction is the production of voltage across a conductor situated in a .....(1) magnetic field or a conductor moving through a stationary magnetic field.

Joseph Henry and Michael Faraday discovered that when the magnetic field around an electromagnet was increased or decreased, an electric current could be detected in a separate nearby conductor. A .....(2) can also be induced by constantly moving a permanent magnet in and out of a coil of wire, or by constantly moving a conductor near a stationary permanent magnet. The induced electromotive force is .....(3) to the rate of change of the magnetic flux cutting across the circuit. Faraday found that the electromotive force (EMF) produced around a closed path is proportional to the rate of change of the magnetic flux through any surface bounded by that path. If

the flux threading a coil is produced by a current in the coil, any change in that current will cause a change in flux, and thus there will be an induced emf while the current is changing. This process is called .....(4). The emf of self-induction is proportional to the rate of change of current.

The process by which an emf is induced in one circuit by a change of current in a neighboring circuit is called mutual induction. Flux produced by a current in a circuit *A* threads or links circuit *B*. When there is a change of current in circuit *A*, there is a change in the flux linking coil *B*, and an emf is induced in circuit *B* while the change is taking place. Transformers operate on the principle of mutual induction.

In practice, this means that an electrical current will be induced in any closed circuit when the magnetic flux through a surface bounded by the conductor changes. This applies whether the field itself changes in strength or the conductor is moved through it. .....(5) induction underlies the operation of generators, induction motors, transformers, and most other electrical machines.

Exercise 5 Read the text in Exercise 4 again and decide whether the statements are true (T) or false (F)

1. Electromagnetic induction is produced only when there is a current in the conductor.
2. Joseph Henry and Michael Faraday found that an electric current could be induced in a separate conductor if it is placed in a changing magnetic field.
3. Mutual induciton happens when a circuit is placed in changing electric field of another circuit.
4. The operation principle of a transformer is based on self-induction.
5. Faraday discovered that the electromotive force induced in a closed circuit is inversely proportional to the magnetic flux thorugh the circuit.

LANGUAGE WORK

Exercise 6 Complete the sentences by finding the missing letters

1. The term electromagnetic i……n refers to the generation of an electric current by passing a metal wire through a magnetic field.
2. The purpose of a p……t magnet is to produce flux in the working gap of a device.
3. Magnetic flux is the product of the average magnetic field times the p……r area that it penetrates.

4. M……l induction is the production of an electromotive force in one circuit by a change in current in another circuit.
5. An induction motor (IM) is a type of as……..s AC motor where power is supplied to the rotating device by means of electromagnetic induction.
6. The number of t…….s of wire directly relates to the strength of the magnetic field.

UNIT 4 TRANSFORMERS

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. electromagnetism	Hiện tượng từ giảo
2. electromagnetic induction	Hiện tượng điện từ
3. induce	Độ thẩm thấu từ
4. magnetic permeability	Cảm ứng điện từ
5. leakage flux	Cảm ứng, sinh ra
6. Winding resistance	Sự nóng lên (nhiệt) do điện trở
7. resistive heating	Từ thông rò rỉ
8. skin effect	Hiệu ứng gần
9. proximity effect	Điện trở của cuộn dây
10.Hysteresis	hiện tượng từ trễ
11.reverse	Đảo chiều
12.Stray losses	Tổn hao do tạp tán
13.peak flux density	Dòng phu cô
14.Eddy currents	Hiệu ứng thoáng qua, nhẹ
15.Ferromagnetic material	Vật liệu sắt từ
16.short-circuited	Mật độ từ thông cao nhất
17.frictional heating	Sự nóng (lên nhiệt) do ma sát
18.inverse square	Đoản mạch
19.Magnetostriction	Bình phương nghịch đảo

Exercise 2 T.S 1 Listen and practise

1. inductively coupled	2. electromagnetism	3. Stray losses
4. magnetic permeability	5. induce	6. leakage flux
7. Winding resistance	8. resistive heating	9. skin effect
10.proximity effect	11.Hysteresis	12.reverse
13.electromagnetic induction	14.peak flux density	15.Eddy currents
16.Ferromagnetic material	17.short-circuited	18.frictional heating
19.inverse square	20.Magnetostriction	

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

T.S 2

1. The EMF of a transformer at a given flux density increases with frequency.

2. Winding resistance dominates load losses, whereas hysteresis and eddy currents losses contribute to over 99% of the no-load loss.

3. Iron losses are caused mostly by hysteresis and eddy current effects in the core.

4. The transformer principle was demonstrated in 1831 by Michael Faraday, although he used it only to demonstrate the principle of electromagnetic induction and did not foresee its practical uses.

5. Any leakage flux that intercepts nearby conductive materials such as the transformer's support structure will give rise to eddy currents and be converted to heat.

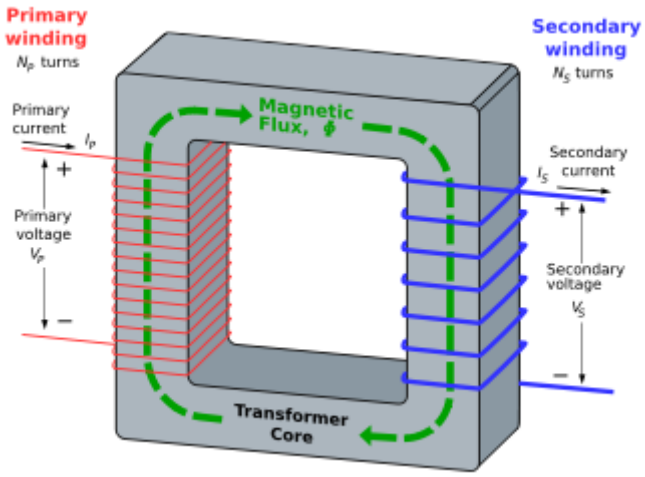
LISTENING

Exercise 4 T.S 3 Listen and decide whether the following sentences are true (T) or false (F)

1. A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled electrical conductors.
2. The transformer is based on two principles: firstly that an electric current can produce a electric field (electromagnetism) and secondly that a

changing magnetic field within a coil of wire induces a voltage across the ends of the coil (electromagnetic induction).

3. By changing the current in the primary coil, it changes the strength of its magnetic field; since the changing magnetic field extends into the secondary coil, a voltage is induced across the primary.



An ideal step-down transformer showing magnetic flux in the core

4. A current passing through the primary coil creates a magnetic field.

5. The primary and secondary coils are wrapped around a core of very high magnetic permeability, such as copper.

6. This ensures that most of the magnetic field lines produced by the primary current are within the iron and pass through the secondary coil as well as the primary coil.

READING Energy losses

Exercise 5 Read the following passage carefully and choose the right kind of energy loss in a transformer according to the description.

Transformers are among the most efficient of machines, but all exhibit losses. Transformer losses are divided into losses as follows:

Eddy currents
Winding resistance
Hysteresis losses
Magnetostriction
Stray losses
Mechanical losses

1. ……

Current flowing through the windings causes resistive heating of the conductors. At higher frequencies, skin effect and proximity effect create additional winding resistance and losses.

2. …….
Each time the magnetic field is reversed, a small amount of energy is lost due to hysteresis within the core. For a given core material, the loss is proportional to the frequency, and is a function of the peak flux density to which it is subjected.

3. …….
Ferromagnetic materials are also good conductors, and a solid core made from such a material also constitutes a single short-circuited turn throughout its entire length. Eddy currents therefore circulate within the core in a plane normal to the flux, and are responsible for resistive heating of the core material. The eddy current loss is a complex function of the square of supply frequency and inverse square of the material thickness.

4. …….
Magnetic flux in a ferromagnetic material, such as the core, causes it to physically expand and contract slightly with each cycle of the magnetic field, an effect known as magnetostriction. This produces the buzzing sound commonly associated with transformers, and in turn causes losses due to frictional heating in susceptible cores.

5. ……
In addition to magnetostriction, the alternating magnetic field causes fluctuating electromagnetic forces between the primary and secondary windings. These incite vibrations within nearby metalwork, adding to the buzzing noise, and consuming a small amount of power.

6. ……
Leakage inductance is by itself lossless, since energy supplied to its magnetic fields is returned to the supply with the next half-cycle. However, any leakage flux that intercepts nearby conductive materials such as the transformer's support structure will give rise to eddy currents and be converted to heat.

LANGUAGE WORK

Exercise 6 Complete the sentences by finding the missing letters

1. E……m is the physics of the electromagnetic field: a field which exerts a force on particles that possess the property of electric charge.
2. In electromagnetism, p……..y is the degree of magnetization of a material that responds linearly to an applied magnetic field.

3. Magnetic flux l…….e (MFL) is a magnetic method of nondestructive testing that is used to detect corrosion and pitting in steel structures.
4. W……g resistance and motor current produce power loss in the form of heat and motor temperature rise (TPR).
5. Resistive h……..g has possible advantages compared with other active warming systems because it can heat several fields independently.
6. If an alternating magnetic field is applied to the material, its magnetization will trace out a loop called a h……..s loop.
7. The goal of placing electromagnetic shields in the distribution transformer tank walls is to reduce the s……..y losses.
8. Although e……..y currents can be induced in any electrical conductor, the effect is most pronounced in solid metallic conductors.
9. F……..c materials have a large and positive susceptibility to an external magnetic field.
10. M…….n is the changing of a material's physical dimensions in response to changing its magnetization.

UNIT 5 ELECTRICITY GENERATION

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. Electricity generation	Sự đốt cháy
2. power station	Nhà máy điện
3. electromechanical generator	Sự phát điện
4. heat engines	Máy phát điện cơ
5. combustion	Sự phân hạt nhân
6. nuclear fission	Động năng
7. kinetic energy	Pin quang điện mặt trời
8. solar photovoltaics	Hơi nóng, hơi nước
9. turbines	Động cơ nhiệt
10.Steam	Nhiên liệu hóa thạch
11.fossil fuel	Đập thủy điện
12.biomass	Tuốc bin
13.Geothermal power	Lực của thủy triều
14.hydroelectric dam	Năng lượng địa nhiệt
15.tidal force	Dầu mỏ
16.chimney	Sinh chất, sinh khối
17.petroleum	ống khói

Exercise 2 T.S 1 Listen and practise

1.Electricity generation	6. nuclear fission	11. fossil fuel	16. tidal force
2. power station	7. kinetic energy	12. biomass	17.Solar updraft tower
3.electromechanical generator	8. solar photovoltaics	13. solar parabolic trough	18. chimney
4. heat engines	9. turbines	14. Geothermal power	19. solar thermal energy
5. combustion	10. Steam	15. hydroelectric dam	20. petroleum

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

Electricity generation	nuclear fission	fossil fuel	tidal force
power station	kinetic energy	biomass	Solar updraft tower
electromechanical generator	solar photovoltaics	solar parabolic trough	chimney
heat engines	turbines	Geothermal power	solar thermal energy
combustion	Steam	hydroelectric dam	petroleum

1. Combined cycle gas ……plants are driven by both steam and gas.
2. Fluid-based magnetohydrodynamic (MHD) power generation has been studied as a method for extracting electrical power from nuclear reactors and also from more conventional fuel ……systems.
3. Sources of electricity in the U.S. in 2006; …… generation (mainly coal) was the largest source.
4. Electrochemical ……is also important in portable and mobile applications.

5. Until recently, ……..were most commonly used in remote sites where there is no access to a commercial power grid, or as a supplemental electricity source for individual homes and businesses.

LISTENING

Exercise 4 T.S 3 Listen to the following passage and write down the missing words

Electricity generation is the process of …….. (1) non-electrical energy to electricity. For electric utilities, it is the first process in the delivery of . …….. (2) consumers. The other processes, electric power transmission and electricity distribution, are normally carried out by the electrical …….. (3) industry. Electricity is most often generated at a power station by electromechanical …….. (4) , primarily driven by heat engines fueled by chemical combustion or nuclear fission but also by other means such as the kinetic energy of flowing water and wind. There are many other …….. (5) that can be and are used to generate electricity such as solar photovoltaics.

READING

Exercise 5 Read the following passage and choose a suitable word from the box to fill in the gap.

Water	Hot gas	turbines	heating
drive	Steam	Wind	heat engines

Methods of generating electricity

Most electric generation is driven by …….. (1). The combustion of fossil fuels supplies most of the heat to these engines, with a significant fraction from nuclear fission. Virtually all of the heat engines just mentioned are …….. (2) . Other types of turbines can be driven by wind or falling water. All turbines are driven by a fluid acting as an intermediate energy carrier. These fluids can be:

- …….. (3) - Water is boiled by nuclear fission, the burning of fossil fuels (coal, natural gas, or petroleum) or biomass. Some power plants use the sun as the heat source: solar parabolic troughs and solar power towers concentrate sunlight to heat a heat transfer fluid,

which is then used to produce steam. Another renewable source of heat used to …….. (4) a turbine is Geothermal power. Either steam under pressure emerges from the ground and drives a turbine or hot water evaporates a low boiling liquid to create vapour to drive a turbine.

- …….. (5) (hydroelectric) - Turbine blades are acted upon by flowing water, produced by hydroelectric dams or tidal forces.
- …….. (6) - Most wind turbines generate electricity from naturally occurring wind. Solar updraft towers use wind that is artificially produced inside the chimney by …….. (7) it with sunlight, and are more properly seen as forms of solar thermal energy.
- …….. (8) (gas turbine) - Turbines are driven directly by gases produced by the combustion of natural gas or oil.

Exercise 6 Complete the sentences by finding the missing letters

1. P…….m engineering refers to the subsurface engineering activities related to the production of hydrocarbons, which can be either crude oil or gas.
2. Electricity g……..n is the process of converting non-electrical energy to electricity.
3. A power s……..n (also referred to as power plant) is an industrial facility for the generation of electric power.
4. The steam t…….e is a very important engine, used in powerplants to produce current.
5. An e……..l generator converts mechanical vibrational energy into electrical energy.
6. A heat e……e typically uses energy provided in the form of heat to do work and then exhausts the heat which cannot be used to do work.
7. C……..n or burning is a complex sequence of exothermic chemical reactions between a fuel and an oxidant accompanied by the production of heat or both heat and light in the form of either a glow or flames.
8. P……c technology makes use of the abundant energy in the sun, and it has little impact on our environment.
9. Formed from plants and animals that lived up to 300 million years ago, f……..l fuels are found in deposits beneath the earth.
10. There are three g……..l power plant technologies being used to convert hydrothermal fluids to electricity.

UNIT 6 ELECTRIC MOTORS

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. mechanical energy	Cổ góp
2. armature	Cơ năng
3. reverse polarity	cuộn dây kích thích
4. impedance	đảo cực
5. pulsating force	đầu máy xe lửa
6. traction motor	Động cơ kéo
7. electric railways	Động cơ xén cỏ
8. locomotives	Đường xe điện
9. torque	lực mạch động
10.compact design	Mạch tyristo
11.commutator	mô men xoắn, mô men quay
12.thyristor circuit	nửa chu kỳ
13.half-wave	Phần ứng
14.revolutions per minute (rpm)	Ray tiếp xúc
15.weed trimmer motors	số vòng quay trong một giây
16.field windings	thiết kế nhỏ gọn
17.third rail	Trở kháng

Exercise 2 T.S 1 Listen and practise

1. mechanical energy	**7.** electric railways	**13.**half-wave
2. armature	**8.** locomotives	**14.**revolutions per minute (rpm)
3. reverse polarity	**9.** torque	15.weed trimmer motors
4. impedance	**10.**compact design	16.field windings
5. pulsating force	**11.**commutator	17.third rail
6. traction motor	**12.**thyristor circuit	

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

mechanical energy	electric railways	half-wave
armature	locomotives	revolutions per minute (rpm)
reverse polarity	torque	weed trimmer motors
impedance	compact design	field windings
pulsating force	commutator	third rail
traction motor	thyristor circuit	

1. An inside rotor attached to the output shaft that is given a ……by the rotating field.
2. An electric motor uses electrical energy to produce ……
3. Universal motors can rotate at relatively ……..(rpm).
4. a small fan blade attached to the ……acts as an artificial load to limit the motor speed to a safe value.
5. By changing the ……connected to the rotor circuit, the speed/current and speed/torque curves can be altered.

READING: Universal motors

Exercise 4 Read the passage carefully and decide whether the statements are true (T) or false (F)

A variant of the wound field DC motor is the universal motor. The name derives from the fact that it may use AC or DC supply current, although in practice they are nearly always used with AC supplies. The principle is that in a wound field DC motor the current in both the field and the armature (and hence the resultant magnetic fields) will alternate (reverse polarity) at the same time, and hence the mechanical force generated is always in the same direction. In practice, the motor must be specially designed to cope with the AC current (impedance must be taken into account, as must the pulsating force), and the resultant motor is generally less efficient than an equivalent pure DC motor. Operating at normal power line frequencies, the maximum output of universal motors is limited and motors exceeding one kilowatt are rare. But universal motors also form the basis of the traditional railway traction motor in electric railways. In this application, to keep their electrical efficiency high, they were operated from very low frequency AC supplies, with 25 Hz and 16 $^{2}/_{3}$ hertz operation being common. Because they are universal motors, locomotives using this design were also commonly capable of operating from a third rail powered by DC.

The advantage of the universal motor is that AC supplies may be used on motors which have the typical characteristics of DC motors, specifically high starting torque and very compact design if high running speeds are used. The negative aspect is the maintenance and short life problems caused by the commutator. As a result such motors are usually used in AC devices such as food mixers and power tools which are used only intermittently. Continuous speed control of a universal motor running on AC is very easily accomplished using a thyristor circuit, while stepped speed control can be accomplished using multiple taps on the field coil. Household blenders that advertise many speeds frequently combine a field coil with several taps and a diode that can be inserted in series with the motor (causing the motor to run on half-wave rectified AC).

1. The universal motor can operate in AC only.
2. Impedence is not important in designing a universal motor.
3. It is dificult for a universal motor to produce the output of over one kilowatt when operating at normal power line frequencies.
4. The commutator can work for a short time.
5. A thyristor circuit is a solution to continuous speed control of a universal motor running on AC

Exercise 5 Choose a correct word to fill in the gap

useful	rotate	limit	cost
into	permanent	due to	exceed

Universal motors can …… (1)at relatively high revolutions per minute (rpm). This makes them …… (2)for appliances such as blenders, vacuum cleaners, and hair dryers where high-speed operation is desired. Many vacuum cleaner and weed trimmer motors exceed 10,000 rpm, Dremel and other similar miniature grinders will often ……(3)30,000 rpm. Motor damage may occur …… (4)overspeed (rpm in excess of design specifications) if the unit is operated with no significant load. On larger motors, sudden loss of load is to be avoided, and the possibility of such an occurrence is incorporated …… (5)the motor's protection and control schemes. Often, a small fan blade attached to the armature acts as an artificial load to …… (6)the motor speed to a safe value, as well as provide cooling airflow to the armature and field windings.

With the very low …… (7)of semiconductor rectifiers, some applications that would have previously used a universal motor now use a pure DC motor, sometimes with a …… (8)magnet field.

Exercise 6 Complete the sentences by finding the missing letters

1. The energy acquired by the objects upon which work is done is known as m……l energy.

2. In electrical engineering, an a……e is one of the two principal electrical components of an electromechanical machine--a motor or generator.

3. Electrical i……e describes a measure of opposition to a sinusoidal alternating current (AC).

4. A t……n motor is a type of electric motor used to power the driving wheels of a vehicle such as a railroad locomotive, electrical multi-unit train (such as a subway or light rail vehicle train), a tram, or an automobile.

5. A l……e is a railway vehicle that provides the motive power for a train.

6. A t……e (τ) in physics, also called a moment, is a vector that measures the tendency of a force to rotate an object about some axis.

7. A c……r is an electrical switch that periodically reverses the current direction in an electric motor or electrical generator.

8. R……ns per minute (abbreviated rpm, RPM, r/min, or $r \cdot min^{-1}$) is a unit of frequency: the number of full rotations completed in one minute around a fixed axis.

UNIT 7 BATTERIES

Vocabulary and Pronunciation

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
Battery	pin sơ cấp
Charge	pin điện phân
charging current	có thể nạp lại
chemical energy	pin thứ cấp
chemical reaction	pin nhiên liệu
Discharge	nạp, sạc
Disposable	dòng điện nạp (sạc)
electrochemical	pin, ắc quy
electrolytic cell	phản ứng hóa học
fuel cell	pin vonta
irreversible reaction	dùng một lần
primary cell	phản ứng không thuận nghịch
Rechargeable	hóa năng
secondary cell	xả, phóng điện
voltaic pile	điện hóa

Exercise 2 T.S 1 Listen and practise

1. battery
2. charge
3. charging current
4. chemical energy
5. chemical reaction
6. discharge
7. disposable
8. electrochemical
9. electrolytic cell
10. fuel cell
11. irreversible reaction
12. primary cell
13. rechargeable
14. secondary cell
15. voltaic pile

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

fuel cell	secondary cells	irreversible reaction
Charge	electrolytic cell	primary cell
charging current	electrochemical	rechargeable

1. A …… is an electrochemical conversion device.
2. An …… is an reaction which cannot be changed.
3. …….. is the current that flows into a capacitor when a voltage is first applied.
4. A rechargeable battery is a group of two or more …….. .
5. The anode of an ……is positive, and the cathode is negative.

READING:

BATTERY

In electronics, a battery is two or more electrochemical cells which store chemical energy and make it available as electrical energy. Common usage has evolved to include a single electrical cell in the definition. There are many types of electrochemical cells, including galvanic cells, electrolytic cells, fuel cells, flow cells and voltaic piles. A battery's characteristics may vary due to many factors including internal chemistry, current drain and temperature.

One common division of batteries distinguishes two types: primary (disposable) and secondary (rechargeable). Primary batteries are designed to be used once only because they use up their chemicals in an effectively irreversible reaction. Secondary batteries can be recharged because the chemical reactions they use are reversible; they are recharged by running a charging current through the battery, but in an opposite direction to the discharge current. Secondary, also called rechargeable batteries can be charged and discharged many times before wearing out. After wearing out some batteries can be recycled.

The name "battery" was coined by Benjamin Franklin for an arrangement of multiple Leyden jars (an early type of capacitor) after a *battery* of cannon.

Although an early form of electrochemical battery may have been used in antiquity, the modern development of batteries started with the Voltaic pile, invented by the Italian physicist Alessandro Volta in 1800. Since then, batteries have gained popularity as they became portable and useful for many purposes. The widespread use of batteries has created many environmental concerns, such as toxic metal pollution. Many reclamation companies recycle batteries to reduce the number of batteries going into landfills.

Exercise 4: Are these sentences true (T) or false (F)?

1. A battery is two or more electrochemical cells which store electrical energy and make it available as chemical energy.
2. Internal chemistry, current drain and temperature are factors that contribute to a battery's characteristics.
3. A primary battery is rechargeable while a secondary is disposable.
4. In primary batteries, the chemical reactions are reversible while in secondary batteries, the chemical reactions are irreversible.
5. Secondary batteries can be charged and discharged many times before wearing out.
6. An early form of electrochemical battery was invented by the Italian physicist Alessandro Volta in 1800
7. Since the invention of the Voltaic pile, batteries have gained popularity as they became portable and useful for many purposes.
8. One of the environmental concerns caused by use of batteries is toxic metal pollution.

LISTENING:

Exercise 5 Listen to T.S3 and fill in the blanks with the words given

Environment	chemicals	purchase
Landfills	regulations	materials
Services	harmful	elements
Mercury		

BATTERIES - ENVIRONMENTAL CONCERNS

Battery manufacture consumes resources and often involves hazardous (1) …… . Used batteries also contribute to electronic waste. Some areas now have battery recycling (2) …… available to recover some of the (3)

…… from used batteries. Batteries may be (4) …….. or fatal if swallowed. Recycling or proper disposal prevents dangerous (5) …….. (such as lead, mercury, and cadmium) found in some types of batteries from entering the (6) …… . In the United States, Americans (7) …….. nearly three billion batteries annually, and about 179,000 tons of those end up in (8) …….. across the country. In the United States the Environmental Protection Agency's Mercury-Containing and Rechargeable Battery Management Act of 1996, has reduced the amount of (9) ……. in regular household batteries. Recycling programs for lead and cadmium batteries have been put in place. Recycling and disposal (10) …….. may in the future apply to alkaline and nickel-metal hydride batteries.

LANGUAGE WORK

We use CAN to express possiblity or ability: S + CAN + V infinitive

E.g

We can produce electricity using a generator.

Exercise 6 Match a line in A with a line in B to make meaningful sentences.

A	B
1. We can recharge	a. light bulbs to either AC or DC sources.
2. We can extended	b. a simple wet zinc-carbon battery in the laboratory using dilute sulphuric acid as an electrolyte solution.
3. We can make	c. the simple half wave rectifier in two versions with the diode pointing in opposite directions.
4. We can connect	d. secondary batteries by applying electrical current.
5. We can build	e. battery life by storing the batteries at a low temperature.

When we change the sentence into passive, we can use the fomula:

S + CAN + BE + PAST PARTICIPAL

E.g.

Active: *We can produce electricity using a generator.*
Passive: *Electricity can be produced using a generator.*

Exercise 7 Change the following sentences into passive

1. We can recharge secondary batteries by applying electrical current.
2. We can extend battery life by storing the batteries at a low temperature.
3. We can make a simple wet zinc-carbon battery in the laboratory using dilute sulphuric acid as an electrolyte solution.
4. We can connect light bulbs to either AC or DC sources.
5. We can build the simple half wave rectifier in two versions with the diode pointing in opposite directions.

UNIT 8 INCANDESCENT LIGHT BULB

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. incandescence	bóng thủy tinh
2. filament	quang phổ liên tục
3. glass bulb	dây tóc
4. headlamp	đèn huỳnh quang
5. tungsten	nóng sáng
6. fluorescent light	đui cài
7. high-intensity	ánh sáng nhìn thấy
8. inert gas	vonfram
9. continuous spectrum	cường độ cao
10. visible light	đèn pha
11. screw base	khí trơ
12. bayonet base	tiếp xúc
13. leak (n,v)	rò rỉ
14. insulation	cách (điện, nhiệt)
15. contact	đui xoáy

Exercise 2 T.S 1 Listen and practise

1. incandescence	6. fluorescent light	11. screw base
2. filament	7. high-intensity	12. bayonet base
3. glass bulb	8. inert gas	13. leak
4. headlamp	9. continuous spectrum	14. insulation
5. tungsten	10. visible light	15. contact

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

incandescence	fluorescent light	screw base
filament	high-intensity	bayonet base
light bulb	inert gas	visible light

1. ……. is the emission of …….. from a hot body due to its temperature.

2. A ……. is a gas-discharge lamp that uses electricity to excite mercury vapor.

3. ……. discharge lamps are a type of arc lamp.

4. The first successful …….. filaments were made of carbon, later replaced with tungsten.

5. An …….. is any gas that is not reactive under normal circumstances.

LISTENING:

Exercise 4 Listen to T.S3 and fill in the blanks with the words given

voltages	household	headlamps
Lighting	incandescence	glass bulb
filament	equipment	fluorescent
Electrical		

The incandescent light bulb is a source of artificial light that works by (1) …….. . An electric current passes through a thin (2) ……., heating it until it produces light. The enclosing (3) …….. prevents the oxygen in air from reaching the hot filament, which otherwise would be destroyed rapidly by oxidation.

Incandescent bulbs are made in a wide range of sizes and (4) ……. , from 1.5 volts to about 300 volts. They require no external regulating (5) ……. and have a low manufacturing cost, and work well on either alternating current or direct current. As a result the incandescent lamp is widely used in (6) ……. and commercial lighting, for portable lighting, such as table lamps, some car (7) ……. and electric flashlights, and for decorative and advertising lighting.

Incandescent light bulbs are gradually being replaced in many applications by (8) …….. lights, high-intensity discharge lamps, LEDs, and other devices, which give more visible light for the same amount of (9) ……. energy input. Some jurisdictions are attempting to ban the use of incandescent lightbulbs in favour of more energy-efficient (10) …… .

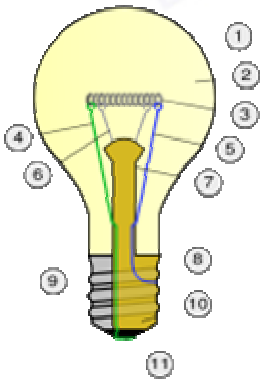
READING

CONSTRUCTION OF LIGHTBULB

Incandescent light bulbs consist of a glass enclosure (the envelope, or bulb) which is filled with an inert gas to reduce evaporation of the filament. Inside the bulb is a filament of tungsten wire, through which an electric current is passed. The current heats the filament to an extremely high temperature (typically 2000 K to 3300 K depending on the filament type, shape, size, and amount of current passed through). The heated filament emits light that approximates a continuous spectrum. The useful part of the emitted energy is visible light, but most energy is given off in the near-infrared wavelengths.

Incandescent light bulbs usually contain a glass mount, which supports the filament lead wires and allows the electrical contacts to run through the envelope without gas/air leaks. Many arrangements of electrical contacts are used. Large lamps may have a screw base (one or more contacts at the tip, one at the shell) or a bayonet base (one or more contacts on the base, shell used as a contact or used only as a mechanical support). Some tubular lamps have an electrical contact at either end. Miniature lamps may have a wedge base and wire contacts, and some automotive and special purpose lamps have screw terminals for connection to wires. Contacts in the lamp socket allow the electric current to pass through the base to the filament. Power ratings range from about 0.1 watt to about 10,000 watts.

Exercise 5: Match each on the left with its name on the right



a. Contact wire (goes out of stem)
b. Low pressure inert gas (argon, neon, nitrogen)
c. Electrical contact
d. Tungsten filament
e. Support wires
f. Contact wire (goes into stem)
g. Contact wire (goes out of stem)
h. Stem (Glass mount)
i. Insulation (Vitrite)
j. Cap (Sleeve)
k. Outline of Glass bulb

Exercise 6: Are the following sententences true (T) or false (F)?

1. The glass enclosure of the incandescent light bulbs is filled with an inert gas.
2. The filament type, shape, and size decide the amount of current passing through it.
3. The only function of the glass mount is to support the filament lead wires.
4. A screw base has one or more contacts at the tip, one at the shell while a bayonet base has one or more contacts on the base, shell used as a contact or used only as a mechanical support.
5. Large lamps may have a screw base or a wedge base.
6. Some tubular lamps have an electrical contact at either end and wire contacts.
7. Automotive and special purpose lamps have screw terminals for connection to wires.
8. Contacts in the lamp socket allow the electric current to pass through the filament to the base.

LANGUAGE WORK

Noun phrase (1)

A noun phrase in English may take the following structure:

Adverb + Past Participle + Noun

E.g: A horizontally polarized antenna

The noun phrase 'A horizontally polarized antenna' means "an antanna which is polarized horizontally"

Exercise 7 Convert each of the following clauses into a noun phrase

E.g: An antanna which is polarized horizontally

→ A horizontally polarized antenna

1. doms which are mounted eccentrically
2. A resistor which is connected directly
3. An atom which carries positive charge
4. A mechanism which is operated electrically
5. A bridge which is operated manually
6. A detector which is coupled eletromagnetically.

Exercise 8 Translate the noun phrase into Vietnamese

E.g.

A horizontally polarized antenna (An antanna which is polarized horizontally)

→ Một ăng-ten được phân cực kiểu nằm ngang

1. ecentrically mounted doms (doms which are mounted eccentrically)
2. directly connected resistor (A resistor which is connected directly)
3. positively charged atom (An atom which carries positive charge)
4. electrically operated mechanism (A mechanism which is operated electrically)
5. manually operated bridge (A bridge which is operated manually)
6. eletromagnetically coupled detector (A detector which is coupled eletromagnetically)

UNIT 9 CIRCUIT BREAKER

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. arc	lỗi, trục trặc, hư hỏng
2. circuit breaker	bộ biến đổi, biến thế, biến áp
3. compressed air	đoản mạch, ngắn mạch
4. electrical circuit	công tắc
5. fault	không khí nén
6. fuse	mạch điện
7. latch	cắt điện, cầu giao
8. overload	hồ quang
9. Relay	cơ cấu đóng mạch, chuyển mạch
10.self-contained	chốt, then
11.short circuit	độc lập, có đủ các bộ phận
12.Spring	Quá tải
13.switch	rơ le
14.switchgear	lò xo
15.transformer	cầu chì

Exercise 2 T.S 1 Listen and practise

1. arc
2. circuit breaker
3. compressed air
4. electrical circuit
5. fault
6. fuse
7. latch
8. overload
9. relay
10. self-contained
11. short circuit
12. spring
13. switch
14. switchgear
15. transformer

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap

Transformer	fuses	short circuit
circuit breakers	switch	spring
electrical circuit	Relay	switchgear

1. An **……** is a path which electrons from a voltage or current source follow.

2. A …… usually consists of two coils of wire wound on the same core.

3. A …… allows a current along a different path from the one intended.

4. A …… is an electrical ……. that opens and closes under the control of another electrical circuit.

5. The term …… refers to the combination of electrical disconnects, …….. and …… used to isolate electrical equipment.

LISTENING

Exercise 4 Listen to T.S3 and fill in the blanks with the words given

Operation	circuits	replaced
Application	switch	overload
fuses	short-circuits	switchgear

A 2 pole miniature circuit breaker

Photo of inside of a circuit breaker

Circuit Breakers

A circuit breaker is an automatically-operated electrical (1) …… designed to protect an electrical circuit from damage caused by (2) ……. or short circuit. Unlike a fuse, which operates once and then has to be (3) …… , a circuit breaker can be reset either manually or automatically to resume normal (4) …….. . Circuit breakers are made in varying sizes, from small devices that protect an individual household appliance up to large (5) ……. designed to protect high voltage (6) …… feeding an entire city.

An early form of circuit breaker was described by Edison in an 1879 patent (7) …… , although his commercial power distribution system used (8) ……. . Its purpose was to protect lighting circuit wiring from accidental (9) ……. and overloads.

READING

Operation of Circuit Breakers

All circuit breakers have common features in their operation, although details vary substantially depending on the voltage class, current rating and type of the circuit breaker.

The circuit breaker must detect a fault condition; in low-voltage circuit breakers this is usually done within the breaker enclosure. Circuit breakers for large currents or high voltages are usually arranged with pilot devices to sense a fault current and to operate the trip opening mechanism. The trip solenoid that releases the latch is usually energized by a separate battery, although some high-voltage circuit breakers are self-contained with current transformers, protection relays, and an internal control power source.

Once a fault is detected, contacts within the circuit breaker must open to interrupt the circuit; some mechanically stored energy within the breaker is used to separate the contacts, although some of the energy required may be obtained from the fault current itself. The stored energy may be in the form of springs or compressed air. Small circuit breakers may be manually operated; larger units have solenoids to trip the mechanism, and electric motors to restore energy to the springs.

The circuit breaker contacts must carry the load current without excessive heating, and must also withstand the heat of the arc produced when interrupting the circuit. Contacts are made of copper or copper alloys, silver alloys, and other materials. Service life of the contacts is limited by the erosion due to interrupting the arc. Miniature circuit breakers are usually discarded when the

contacts are worn, but power circuit breakers and high-voltage circuit breakers have replaceable contacts.

When a current is interrupted, an arc is generated - this arc must be contained, cooled, and extinguished in a controlled way, so that the gap between the contacts can again withstand the voltage in the circuit. Different circuit breakers use vacuum, air, insulating gas, or oil as the medium in which the arc forms.

Exercise 5: Are the following sentences true (T) or false (F)?

1. All circuit breakers have common features in their operation, but details are not always the same.
2. In low-voltage circuit breakers a fault condition is detected within the breaker enclosure.
3. The only function of pilot devices is to sense a fault current.
4. The trip solenoid that releases the latch is self-contained with current transformers, protection relays, and an internal control power source.
5. Contacts within the circuit breaker must open to interrupt the circuit when some mechanically stored energy within the breaker is used to separate the contacts.
6. The circuit breaker contacts must withstand the heat of the arc produced when interrupting the circuit.
7. The erosion due to interrupting the arc limits the service life of the contacts.
8. Miniature circuit breakers are usually replaced when the contacts are worn.
9. When a current is interrupted, an arc is extinguished in a controlled way by the current.
10. Vacuum, air, insulating gas, or oil can be used in different circuit breakers.

LANGUAGE WORK: Noun phrase (2)

A noun phrase in English may take the following structure:

Noun + Past Participle + Noun

E.g: A hand operated valve

The noun phrase ‘A hand operated valve’ means “a valve which is operated by hand”

Exercise 6 Now convert each of the following clauses into a noun phrase

E.g:

A valve which is operated by hand

→ a hand operated valve

1. transformer which is cooled by air
2. engineering which is aided by a computer
3. switchgear which is insulated by gas
4. end which is sprayed with metal
5. valve which is operated by a motor
6. screen which is coated with phosphor

Exercise 7 Translate the noun phrases into Vietnamese

E.g: hand operated valve (valve which is operated by hand)

→ van được thao tác bằng tay

1. air-cooled transformer (transformer which is cooled by air)
2. computer-aided enginnering (engineering which is aided by a computer)
3. gas-insulated switchgear (switchgear which is insulated by gas)
4. metal-sprayed end (metal sprayed end)
5. motor-operated valve (valve which is operated by a motor)
6. phosphor-coated screen (screen which is coated with phosphor)

UNIT 10 RECTIFIER

VOCABULARY AND PRONUNCIATION

Exercise 1 Match English terms and Vietnamese translations

English	Vietnamese
1. alternating current	dạng sóng
2. anode	bộ chỉnh lưu, bộ nắn dòng
3. arc	dòng xoay chiều
4. cathode	chỉnh lưu cả sóng
5. center-tapped	hồ quang
6. direct current	phân cực, cực tính
7. full-wave rectification	cực dương
8. half wave rectification	nửa dương
9. inverter	đèn chân không
10.negative half	dòng một chiều
11.polarity	cực âm
12.positive half	nửa âm
13.rectifier	bộ đảo điện, bộ đảo lưu
14.vacuum tube	trích giữa
15.waveform	chỉnh lưu nửa sóng

Exercise 2 T.S 1 Listen and practise

1. alternating current	6. direct current	11. polarity
2. anode	7. full-wave rectification	12. positive half
3. arc	8. half wave rectification	13. rectifier
4. cathode	9. inverter	14. vacuum tube
5. center-tapped	10. negative half	15. waveform

Exercise 3 T.S 2 Listen and complete the sentences by selecting the correct word from the box to fill in the gap.

alternating current	direct current	anode
arc	center-tapped	rectifier
cathode	inverter	vacuum tube

1. A …… transformer is a transformer with a tap in the middle of the secondary winding.

2. An …….. is an electrical device that converts …… to …….

3. Some special function …… are filled with low-pressure gas.

4. An …….. is an electrode through which electric current flows into a polarized electrical device.

5. A …… is an electrode through which electric current flows out of a polarized electrical device.

LISTENING:

Exercise 4 Listen to T.S3 and fill in the blanks with the words given

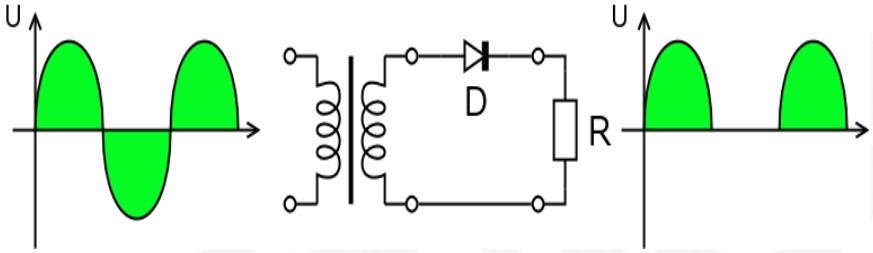
detectors	convert	diodes	components	arrangement
difference	converts	rectification	development	function

A **rectifier** is an electrical device that (1) …… alternating current (AC) to direct current (DC), a process known as (2) …….. . Rectifiers have many uses including as components of power supplies and as (3) …….. of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes, mercury arc valves, and other (4) ……. . A device which performs the opposite (5) …….. (converting DC to AC) is known as an inverter. When only one diode is used to rectify AC (by blocking the negative or positive portion of the waveform), the (6) …… between the term *diode* and the term *rectifier* is merely one of usage, i.e., the term *rectifier* describes a *diode* that is being used to (7) …….. AC to DC. Almost all rectifiers comprise a number of diodes in a specific (8) …… for more efficiently converting AC to DC than is possible with only one diode. Before the (9) …… of silicon semiconductor rectifiers, vacuum tube (10) …… and copper(I) oxide or selenium rectifier stacks were used.

READING

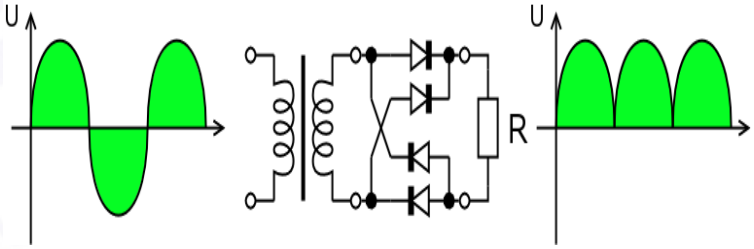
Half-wave rectification

In half wave rectification, either the positive or negative half of the AC wave is passed, while the other half is blocked. Because only one half of the input waveform reaches the output, it is very inefficient if used for power transfer. Half-wave rectification can be achieved with a single diode in a one phase supply, or with three diodes in a three-phase supply.

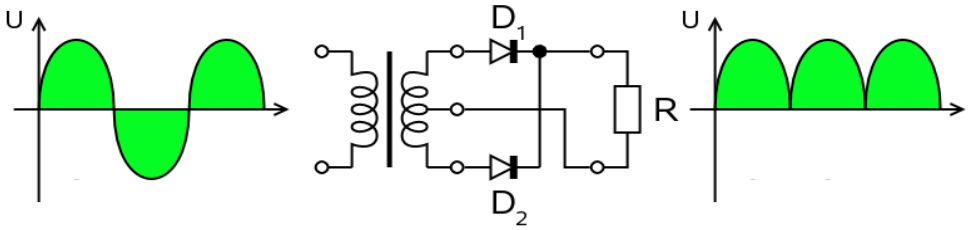


Full-wave rectification

A full-wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output. Full-wave rectification converts both polarities of the input waveform to DC (direct current), and is more efficient. However, in a circuit with a non-center tapped transformer, four diodes are required instead of the one needed for half-wave rectification. (See semiconductors, diode). Four rectifiers arranged this way are called a diode bridge or bridge rectifier:

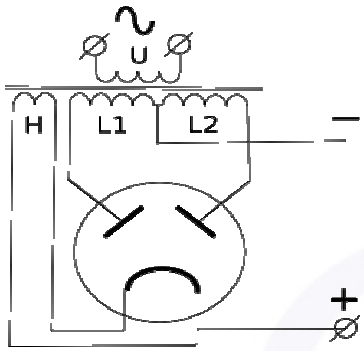


For single-phase AC, if the transformer is center-tapped, then two diodes back-to-back (i.e. anodes-to-anode or cathode-to-cathode) form a full-wave rectifier (in this case, the voltage is half of that for the non-tapped bridge circuit above, and the diagram voltages are not to scale).



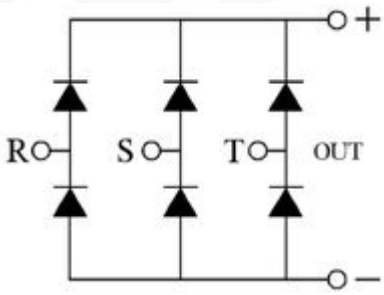
A very common vacuum tube rectifier configuration contained one cathode and twin anodes inside a single envelope; in this way, the two diodes required only

one vacuum tube. The 5U4 and 5Y3 were popular examples of this configuration.



Full-wave rectifier, with vacuum tube having two anodes.

For three-phase AC, six diodes are used. Typically there are three pairs of diodes, each pair, though, is not the same kind of **double diode** that would be used for a full wave single-phase rectifier. Instead the pairs are in series (anode to cathode). Typically, commercially available double diodes have four terminals so the user can configure them as single-phase split supply use, for half a bridge, or for three-phase use.



Exercise 5: Are the following sentences true (T) or false (F)?

1. In half wave rectification, only one half of the AC wave is passed, while the other half is blocked.
2. Half-wave rectification can only be achieved with a single diode in a one phase supply.
3. Full-wave rectification converts both halves of the AC wave to DC.
4. Full-wave rectification is more efficient than half-wave rectification.
5. In half-wave rectification, more diodes are used than in full-wave rectification.
6. A recfifier with a center-tapped transformer requires more diodes than a rectifier with a non-center tapped transformer.

7. A recfifier with a center-tapped transformer is more efficient than a rectifier with a non-center tapped transformer.
8. A common vacuum tube rectifier configuration contained one anode and twin cathodes inside a single envelope.
9. For three-phase AC, three pairs of diodes are used.

LANGUAGE WORK: Noun phrase (3)

A noun phrase in English may take the following structure:

Noun + Present Participle + Noun

E.g: A current-carrying conductor

The noun phrase 'A current-carrying conductor' means "a conductor which is carrying a current"

Exercise 6 Now convert each of the following clauses into a noun phrase

E.g: a conductor which is carrying a current

→ A current-carrying conductor

1. radar which can find direction
2. material which conducts current
3. material which insulates heat
4. device which can sense temperature
5. pump which feeds oil
6. system which processes data

Exercise 7 Translate the noun phrase into Vietnamese

A current-carrying conductor (a conductor which is carrying a current)

→ vật dẫn mang dòng

1. direction finding radar (radar which can find direction)
2. current conducting material (material which conducts current)
3. heat insulating material (material which insulates heat)
4. temperature sensing device (device which can sense temperature)
5. oil feeding pump (pump which feeds oil)
6. data processing system (which processes data)

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