НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ ОДЕСЬКА ПОЛІТЕХНІКА

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ENGLISH FOR ENGINEERS

Підручник для бакалаврів напрямків
«Автомобільний транспорт», «Електротехніка»,
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Даний підручник призначений для використання на практичних заняттях з англійської мови для бакалаврів напрямків «Автомобільний транспорт»,«Електротехніка», «Радіоелектронні апарати», «Програмна інженерія». Методичні матеріали – автентичні тексти та оригінальні вправи – допомагають формувати загальні та професійно орієнтовані комунікативні мовленнєві компетенції (лінгвістичну, соціолінгвістичну і прагматичну) для забезпечення ефективного спілкування в професійному середовищі. Підручник дає можливість підвищити рівень практичного володіння англійською мовою за напрямком.

УДК

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Передмова

Підручник «Англійська мова для інженерів» призначений для бакалаврів немовних вузів наступних напрямків «Автомобільний транспорт», «Електротехніка», «Радіоелектронні апарати», «Програмна інженерія».

Метою підручника є взаємозв'язане формування у студентів вмінь та навичок в різних видах мовної комунікації (читання, письма та говоріння англійською мовою) відповідно до Програми за тематикою включених напрямків.

За рахунок тренування в читанні текстів і виконання завдань комунікативного характеру студенти підвищують рівень практичного володіння англійською мовою за напрямком з рівня B1 до рівня B2 (за критеріями Документа Ради Європи «Загальноєвропейські компетенції володіння іноземною мовою: Вивчення, викладання, оцінка» - CEFR), що дає можливість:

- вільно читати оригінальну літературу іноземною мовою у відповідній галузі знань;
- оформляти витягнуту з іноземних джерел інформацію у вигляді перекладу або резюме;
- робити повідомлення і доповіді іноземною мовою на теми, пов'язані з науковою роботою майбутнього фахівця;
- вести бесіду за напрямком.

Підручник містить 4 основних цикли (Units), об'єднаних за тематикою вказаних напрямків і ідентичними у структурному відношенні. Кожний цикл складається з 10 автентичних текстів та комплексу мовних вправ, які розраховані на удосконалення навичок активізації словарного і граматичного мінімуму професійного спрямування.

При розробці системи завдань і вправ використані елементи функціонально-комунікативного вчення іноземної мови, в якої явища мови розглядаються як система комунікативних функцій, що виконуються певними мовними одиницями. Так, комунікативні функції, типові для текстів зазначених технічних профілів – визначення об'єкту або поняття; розуміння основної ідеї та деталей тексту; розуміння основних положень чітко промовлених висловлювань, обмежених літературною нормою за певною темою; опис-узагальнення на підставі контексту – знаходять своє відображення як у текстовому матеріалі, так і в наборі лексичних одиниць і словосполук.

Лексична наповненість підручника забезпечує підготовку до міжнародного усного і письмового спілкування англійською мовою, що має за мету оволодіння лексичними і стилістичними навичками, а також уміння розмовляти, читати, листуватися, перекладати, конспектувати, згортати і розгортати усну і письмову англомовну інформацію наукового функціонального стилю, що передбачено вимогами Програми вивчення іноземних мов у нефілологічному вузі.

В кінці підручника відповідно до сучасних методичних норм знаходиться додаток – ключи (Keys) до більшості завдань і вправ.

C O N T E N T S

UNIT 1

AUTOMOBILE TRANSPORT

T e x t 1

AUTOMOBILE SYSTEMS

THE READING MODULE

Read the text:

Automobiles are powered and controlled by a complicated interrelationship between several systems. The major systems of the automobile are the power plant, the power train, the running gear, and the control system. Each of these major categories includes a number of subsystems, as shown here. The power plant includes the engine, fuel, electrical, exhaust, lubrication, and coolant systems. The power train includes the transmission and drive systems, including the clutch, differential, and drive shaft. Suspension, stabilizers, wheels and tires are all parts of the running gear, or support system. Steering and brake systems are the major components of the control system by which the driver directs the car.

Automobile, self-propelled vehicle are used primarily on public roads but adaptable to other surfaces. Automobiles changed the world during the 20th century, particularly in the United States and other industrialized nations.From the growth of suburbs to the development of elaborate road and highway systems, the so-called horseless carriage has forever altered the modern landscape. The manufacture, sales, and servicing of automobiles have become key elements of industrial economies; indeed, the health of a country's automobile industry in large measure determines the health of the entire economy. But along with greater mobility and job creation, the automobile has brought air and noise pollution and automobile accidents rank among the leading causes of death and injury throughout the world. But for better or worse, the 1900s can be called the Age of the Automobile and cars will no doubt continue to shape our culture and economy as we enter the 21st century.

Automobiles are classified by size, style, number of doors and intended use. The typical automobile, also called a car, auto, motorcar, and passenger car, has four wheels and can carry up to six people, including a driver.

Larger vehicles designed to carry more passengers are called vans, omnibuses, or buses. Those used to carry cargo are called pickups or trucks, depending on their size and design. Minivans are van-style vehicles built on a passenger car frame that can usually carry up to eight passengers.

The automobile is built around an engine. Various systems supply the engine with fuel, cool it during operation, lubricate its moving parts, and remove exhaust gases it

creates. The engine produces mechanical power that is transmitted to the automobile's wheels through a drive train, which includes a transmission, one or more drive shafts, a differential gear, and axles. Suspension systems, which include springs and shock absorbers, cushion the ride and help protect the vehicle from being damaged by bumps, heavy loads, and other stresses. Wheels and tires support the vehicle on the roadway and, when rotated by powered axles, propel the vehicle forward or backward. Steering and braking systems provide control over direction and speed. An electrical system starts and operates the engine, monitors and controls many aspects of the vehicle's operation, and powers such components as headlights and radios. Safety features such as bumpers, air bags, and seat belts help protect occupants in an accident.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

air bags, automobile, braking systems**,** bumper, clutch, coolant systems**,** differential gear, differential, drive shaft, electrical system, engine, exhaust, fuel, lubrication, seat belts, stabilizers, suspension, tires, wheels

Exercise 2. Answer the questions:

1. How can you classify the automobiles?
2. What automobile types are called pickups or trucks?
3. What are the major components of the control system?
4. What does an electrical system start and operate?

Exercise 3. Match the left part with the right:

1. The power plant includes	a) the major components of the control system, by which the driver directs the car.
2. The power train includes	b) the engine, fuel, electrical, exhaust, lubrication, and coolant systems.
3. Steering and brake systems are	c) the transmission and drive systems, including the clutch, differential, and drive shaft.
4. Suspension, stabilizers, wheels, and tires	d) are all parts of the running gear, or support system.

Exercise 4. Open the brackets choosing the right words:

Suspension systems, which (include/make) springs and shock absorbers, cushion the ride and help protect the vehicle from being (damaged/used) by bumps, heavy loads, and other stresses.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1**.** Describe **air filter; driveshaft; differential gear**; **axle; shock absorber; steering** using the suggested words and expressions as in example:

air filter dirty air; cellulose fibers; is located in; is attached to; carburetor **Example:** The **air filter** is used to keep dirty air from entering the engine. The filter element is typically resin impregnated cellulose fibers (paper) with a mixture of synthetic fibers. The filter is located in a housing that is attached to the throttle body, or in a housing that sits atop the carburetor.
driveshaft transmits; engine torque; the differential; drive wheels
differential gear gear box; the axles; to rotate at different speeds; power to the wheel; prevent wheel spin; high performance
axle a crossbeam; the weight of the vehicle; is connected to; the spindles; pins
shock absorber the suspension; to dampen up-and-down; wheel motions; bumps; chassis movement
steering general term; the angular relationships; the wheels; linkage; suspension

Exercise 2**.** Ask the questions to the given answers:

1. Question: _____ ?

Answer: The major systems of the automobile are the power plant, the power train, the running gear and the control system.

2. Question: _____ ?

Answer: The power plant includes the engine, fuel, electrical, exhaust, lubrication and coolant systems.

3.Question: _____ ?

Answer: The engine produces mechanical power that is transmitted to the automobile's wheels through a drivetrain.

4. Question: _____ ?

Answer: Steering and braking systems provide control over direction and speed.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **by; support; starts; as; over.**

Wheels and tires _____the vehicle on the roadway and, when rotated ___ powered axles, propel the vehicle forward or backward. Steering and braking systems provide control ____ direction and speed. An electrical system _____ and operates the engine, monitors and controls many aspects of the vehicle's operation, and powers such components _____ headlights and radios.

Exercise 2**.** Fill in the table with words and expressions from the text:

	Parts	Systems	Processes
Example: Engine produces	-	-	mechanical power that is transmitted to the automobile's wheels.
Power plant includes			
Power train includes			
Suspension systems include			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Age of the Automobile».
«Automobiles have changed the world».
«The major systems of the automobile».

T e x t 2

OHV ENGINE DESIGN

THE READING MODULE

Read the text:

4-cylinder 8 valves OHV engine

OHV means OverHead Valve - an engine design where the camshaft is installed inside the engine block and valves are operated through lifters, pushrods and rocker arms (an OHV engine also known as «Pushrod» engine). Although an OHV design is a bit outdated, it has been successfully used for decades. An OHV engine is very simple, has more compact size and proven to be durable. Downsides: it's difficult to precisely control the valve timing at high rpm due to higher inertia caused by larger amount of valve train components (lifter-pushrod-rocker arm). Also it's very difficult to install more than 2 valves per cylinder or implement some latest technologies such as Variable Valve Timing - something that could be easily done in a DOHC engine.

4-cylinder 8 valves SOHC engine OHC or SOHC engine

OHC in general means OverHead Cam while SOHC means Single OverHead Cam. In the SOHC engine the camshaft is installed in the cylinder head and valves are operated either by the rocker arms or directly through the lifters in. The advantage is that valves are operated almost directly by the camshaft - easy to achieve the perfect timing at high rpm. Also it's possible to install three or four valves per cylinder. The disadvantage - an OHC engine requires a timing belt or chain with related components - more complex and more expensive design.

DOHC or Twin cam engine

DOHC or Double OverHead Cam - the setup used in many today's cars. Since it's possible to install multiple valves per cylinder and place intake valves on the opposite side from exhaust vales, DOHC engine can «breath» better meaning that it can produce more horsepowers with smaller engine volume. Compare: The 3.5-liter V6 DOHC engine of 2003 Nissan Pathfinder has 240 h.p., similar to 245 h.p. of the 5.9-liter V8 OHV engine of 2003 Dodge 4-cylinder 16 valves DOHC engine Durango. **Pros:** High efficiency, possible to install multiple valves per cylinder and adopt variable timing. **Cons:** More complex and more expensive design.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

camshaft; dependent variable; efficiency; in the opposite direction; in the opposite order; independent variable; inertia; intake; on the opposite side; OverHead pushrod; random variable; rocker arm; variable

Exercise 2. Answer the questions:

1. What does OHV engine design mean?
2. Where is the camshaft installed in SOHC engine?
3. What is the disadvantage of an OHC engine?
4. What are Pros and Cons of the 3.5-liter V6 DOHC engine and the 5.9-liter V8 OHV engine?

Exercise 3. Match the left part with the right:

1. OHV means OverHead Valve - an engine design where	a) is installed in the cylinder head.
2. In the SOHC engine the camshaft	b) «breath» better meaning that it can produce more horsepowers with smaller engine volume.
3. OHC engine requires	c) the camshaft is installed inside the engine block and valves are operated through lifters.
4. Double OverHead Cam engine can	d) has been successfully used for decades.
5. Although an OHV design is a bit outdated, it	e) a timing belt or chain with related components.

Exercise 4. Open the brackets choosing the right words:

DOHC or Double OverHead Cam - the setup (got/used) in many today's cars. Since it's possible to install multiple valves per cylinder and (feel/place) intake valves on the opposite side from exhaust vales.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **intake valve; camshaft; rpm; cylinder; horsepower** using the suggested words and expressions as in example:

intake valve metal; a rod; a flat disc; intake passage; cylinder head

Example: Intake valve is a metal valve that looks like a rod connected to a flat disc that opens/closes the intake passage in the cylinder head.
camshaft inside an engine; lobes; engine's valves; «pushrod» engines; cam lobes; the up and down motion; rocker arms; to actuate the valves
rpm abbreviation; revolutions; per; minute; engine speed; expressed as
cylinder a chamber; within; piston; to move
horsepower a unit of measure; power output; James Watt; a horse; the amount of effort; in one minute; after internal friction

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: OHV means OverHead Valve - an engine design where the camshaft is installed inside the engine block.
2. Question: _____ ?
Answer: OHV engine is also known as «Pushrod» engine.
3. Question: _____ ?
Answer: OHC in general means OverHead Cam while SOHC means Single OverHead Cam.
4. Question: _____ ?
Answer: Double OverHead Cam engine can «breath» better meaning that it can produce more horsepowers with smaller engine volume.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **per; at; with; to; in; by.**

In the SOHC engine the camshaft is installed ____the cylinder head and valves are operated either _____ the rocker arms or directly through the lifters (as in the picture). The advantage is that valves are operated almost directly by the camshaft - easy to achieve the perfect timing ____ high rpm. Also it's possible ____ install three or four valves ____ cylinder. The disadvantage - an OHC engine requires a timing belt or chain ____ related components - more complex and more expensive design.

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Ability	Place
Example: OHV means	OverHead Valve	-	-
the camshaft is installed			
OHC in general means			
DOHC engine can			
it's possible to install multiple valves			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Engine block and valves».
«The valve timing».
«The 3.5-liter V6 DOHC engine of 2003 Nissan Pathfinder».

T e x t 3

SPRINGS

THE READING MODULE

Read the text:

Springs are unlike other machine/structure components in that they undergo significant deformation when loaded - their compliance enables them to store readily recoverable mechanical energy. In a vehicle suspension, when the wheel meets an obstacle, the springing allows movement of the wheel over the obstacle and thereafter returns the wheel to its normal position. Another common duty is in cam follower return - rather than complicate the cam to provide positive drive in both directions, positive drive is provided in one sense only and the spring is used to return the follower to its original position. Springs are common also in force- displacement transducers, e.g. in weighing scales, where an easily discerned displacement is a measure of a change in force. The simplest spring is the tension bar. This is an efficient energy store since all its elements are stressed identically, but its deformation is small if it is made of metal. Bicycle wheel spokes are the only common applications which come to mind. Beams

form the essence of many springs. The deflection δ of the load F on the end of a cantilever can be appreciable - it depends upon the cantilever's geometry and elastic modulus, as predicted by elementary beam theory. Unlike the constant cross- section beam, the **leaf spring** is stressed almost constantly along its length because the linear increase of bending moment from either simple support is matched by the beam's widening - not by its deepening, as longitudinal shear cannot be transmitted between the leaves. The shortcoming of most metal springs is that they rely on either bending or torsion to obtain significant deformations; the stress therefore varies throughout the material so that the material does not all contribute uniformly to energy storage. The wire of a **helical compression spring** is loaded mainly in torsion and is therefore usually of circular cross- section. This type of spring is the most common and we shall focus on it. The **(ex)tension spring** is similar to the compression spring however it requires special ends to permit application of the load - these ends assume many forms but they are all potential sources of weakness not present in compression springs. Rigorous duties thus usually call for compression rather than tension springs. A tension spring can be wound with initial pre-load so that it deforms only after the load reaches a certain minimum value. Springs which are loaded both in tension and in compression are rare and restricted to light duty. All the above mentioned springs are essentially translatory in that forces and linear deflections are involved. Rotary springs involve torque and angular deflection. The simplest of these is the torsion bar in which loading is pure torque; its analysis is based upon the simple torsion equation. Torsion bars are stiff compared to other forms of rotary spring however they do have many practical applications such as in vehicle suspensions. Torsion springs which are more compliant than the torsion bar include the clock - or **spiral torsion spring** and the **helical torsion spring**. These rely on bending for their action, as a simple free body will quickly demonstrate. The helical torsion spring is similar to the helical tension spring in requiring specially formed ends to transmit the load.

The **constant force spring** is not unlike a self- retracting tape measure and is used where large relative displacements are required: the spring motors used in sliding door closers is one of the applications. There exists also a large variety of non-metallic springs often applied to shock absorption and based on rubber blocks loaded in shear. Springs utilising gas compressibility also find some use.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

bending moment; displacement; linear deflection; shock absorption; spring suspension; tension bar; torque; torsion; compression

Exercise 2. Answer the questions:

1. What happens in a vehicle suspension, when the wheel meets an obstacle?
2. What is the (ex)tension spring similar to?
3. What is the helical torsion spring similar to?
4. Where are non-metallic springs often applied?

Exercise 3. Match the left part with the right:

1. In a vehicle suspension, when the wheel meets an obstacle, the springing	a) deforms only after the load reaches a certain minimum value.
2. The simplest spring is	b) also find some use.
3. A tension spring can be wound with initial pre-load so that it	c) allows movement of the wheel over the obstacle.
4. Springs utilising gas compressibility	d) the tension bar.

Exercise 4. Open the brackets choosing the right words:

Rotary springs (come/involve) torque and angular deflection. The simplest of these is the torsion bar in which loading is pure torque; its analysis is (compressed/based) upon the simple torsion equation. Torsion bars are stiff compared to other forms of rotary spring, however they do(have/load) many practical applications such as in vehicle suspensions.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **deformation; deflection; bending**; **torsion; helix; suspension** using the suggested words and expressions as in example:

deformation alteration of shape; stresses; thermal expansion; transformations; shrinkage; expansions **Example: Deformation** is any alteration of shape or dimensions of a body caused by stresses, thermal expansion or contraction, chemical or metallurgical transformations, or shrinkage and expansions due to moisture change.
deflection shape change; reduction in diameter; without fracturing the material
bending a metal part; pressure; a curved shape; angular shape; the stretching; flanging; a curved path

torsion a twisting deformation; a solid body; an axis; lines parallel to; helices
suspension wire; coil; spring; support; the moving element
helix a curve; a cylindrical or conical surface; points of the surface; at the same angle

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: This type of spring is the most common one
2. Question: _____ ?
Answer: A tension spring can be wound with initial pre-load so that it deforms only after the load reaches a certain minimum value.
3. Question: _____ ?
Answer: Rotary springs involve torque and angular deflection.
4. Question: _____ ?
Answer: The helical torsion spring is similar to the helical tension spring in requiring specially formed ends to transmit the load.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **used; exists; find; is; are.**

The constant force spring ___ not unlike a self- retracting tape measure and is ____ where large relative displacements ____ required - the spring motors used in sliding door closers is one application. There _____ also a large variety of non-metallic springs often applied to shock absorption and based on rubber blocks loaded in shear. Springs utilising gas compressibility also _____ some use.

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Place	Processes
Example: Rotary springs involve			torque and angular deflection
Torsion bars are stiff compared to			

Springs are common also in			
The (ex)tension spring is similar to			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Recoverable mechanical energy».
«The simplest spring».
«The leaf spring».
«The shortcoming of most metal springs».

T e x t 4

BATTERIES
THE READING MODULE

Read the text:

The battery is the primary «source» of electrical energy on vehicles. It stores chemicals, not electricity. Two different types of lead in an acid mixture react to produce an electrical pressure. This electrochemical reaction changes chemical energy to electrical energy.

Battery Functions:

1. ENGINE OFF: Battery energy is used to operate the lighting and accessory systems.
2. ENGINE STARTING: Battery energy is used to operate the starter motor and to provide current for the ignition system during cranking.
3. ENGINE RUNNING: Battery energy may be needed when the electrical load requirements of the/a vehicle (inanimate) exceed the supply from the charging system. In addition, the battery also serves as a voltage stabilizer, or large filter, by absorbing abnormal, transient voltages in the vehicle's electrical system. Without this protection, certain electrical or electronic components could be damaged by these high voltages.

Battery Types:

1. PRIMARY CELL: The chemical reaction totally destroys one of the metals after a period of time. Small batteries for flashlights and radios are primary cells.
2. SECONDARY CELLS: The metals and acid mixture change as the battery supplies voltage. The metals become similar, the acid strength weakens. This is called discharging. By applying current to the battery in the opposite direction, the battery

materials can be restored. This is called charging. Automotive lead-acid batteries are secondary cells.

3. WET-CHARGED: The lead-acid battery is filled with electrolyte and charged when it is built. During storage, a slow chemical reaction will cause self-discharge. Periodic charging is required.

4. DRY-CHARGED: The battery is built, charged, washed and dried, sealed, and shipped without electrolyte. It can be stored for 12 to .18 months. When put into use, it requires adding electrolyte and charging.

5. LOW-MAINTENANCE: Such batteries are built to reduce internal heat and water loss. The addition of water should only be required every 15,000 miles or so.

The battery is one of the most important components on a vehicle today. It provides the amps needed to crank and start the engine, and it stores the voltage that runs everything from the ignition system and fuel injectors to the vehicle's lights and all of its electrical accessories. Lead-acid batteries have been around since the earliest days of the automobile and have steadily improved over the years. Today's batteries are more durable, have high power-to-weight ratios and lighter cases. But the basic chemistry is unchanged. A chemical reaction between two dissimilar metals in an acid solution creates voltage. The two dissimilar metals are lead and lead peroxide. The active material on the positive plates is lead peroxide (a soft, dark brown material), while that on the negative plates is finely ground "sponge" lead (which is gray in color). The positive and negative plates are sandwiched together and separated by a nonconductive insulating layer of paper, plastic or micro-woven glass.

The acid is a mixture of 25 percent water and 75 percent sulfuric acid (H2SO4). Battery acid is called the "electrolyte" because it allows charged particles (called "ions") to move between the plates when current is drawn from the battery. A 12-volt battery has six "cells," each of which contains 9 to 20 positive and negative plates. The greater the number of plates, the higher the power output (measured in amps) of the battery. Each cell produces 2.11 volts, so when all six cells are connected together in series, the battery's total output is actually 12.66 volts. As a battery discharges, sulfate combines chemically with the positive and negative plates. This lowers the concentration of acid in the solution, which can be measured by checking the "specific gravity" (density) of the liquid with a hydrometer or built-in charge indicator. As more and more current is pulled out of the battery, sulfate continues to build up on the plates, and the concentration of the acid drops until the battery becomes discharged and no longer produces enough voltage to crank the engine or power the lights or other accessories.

To reverse the chemical reaction and recharge the battery, the charging system senses any drop in voltage and increases its voltage output to push amps back into the battery. This forces the sulfate away from the plates and puts it back into the solution. The concentration of acid goes back up, and the battery returns to full charge.

To produce maximum cranking power and remain healthy, an automotive lead-acid battery must be kept at or near full charge. If the battery is allowed to run down (leaving the lights on, low charging output, slipping drive belt, frequent short-trip driving, long

periods of inactivity, etc.), sulfate can form a barrier on the surface of the plates that makes it difficult for the battery to accept a charge. Over time, this can ruin the plates and cause the battery to fail.

1. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

acid mixture; charging; crank; dissimilar metals; fuel; ignition; lead; lights; power output; sealed

Exercise 2. Answer the questions:

1. What is the primary «source» of electrical energy on vehicles?
2. When may the battery energy be needed?
3. Why may the acid strength weaken?
4. What does battery acid consist of?

Exercise 3. Match the left part with the right:

1. Today's batteries are	a) the positive and negative plates.
2. The positive and negative plates are	b) be kept at or near full charge.
3. As a battery discharges, sulfate combines chemically with	c) more durable, have high power-to-weight ratios and lighter cases.
4. To produce maximum cranking power and remain healthy, an automotive lead-acid battery must	d) sandwiched together and separated by a nonconductive insulating layer of paper, plastic or micro-woven glass.

Exercise 4. Open the brackets choosing the right words:

Lead-acid batteries have been around since the (most/earliest) days of the automobile and have steadily improved over the years. Today's batteries are more durable, have high power-to-weight ratios and (lighter/heavier) cases. But the basic (chemistry/mathematics) is unchanged. A chemical reaction between two (well-known/dissimilar) metals in an acid solution creates voltage. The two dissimilar metals are lead and lead (gold/peroxide).

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **electrochemical effect; battery; current; solution** using the suggested words and expressions as in example:

electrochemical effect conversion; electric energy; electrochemical cells; reverse process; elemental aluminum; magnesium; bromine; compounds; elements **Example:** The **electrochemical effect** is a conversion of chemical to electric energy, as in electrochemical cells; or the reverse process, used to produce elemental aluminum, magnesium, and bromine from compounds of these elements.
battery direct-current voltage; source; to convert; chemical, thermal, nuclear, or solar energy; electrical energy
current transfer; electric charge; device; a circuit; electric current
solution homogeneous liquid; solid, or gas phase; a mixture; components (liquid, gas, solid, or combinations thereof); uniformly; to distribute

Exercise 2. Ask the questions to the given answers:

1.Question: _____ ?

Answer: Battery energy is used to operate the lighting and accessory systems.

2. Question: _____ ?

Answer: The chemical reaction totally destroys one of the metals after a period of time.

3. Question: _____ ?

Answer: The battery is built, charged, washed and dried, sealed, and shipped without electrolyte.

4. Question: _____ ?

Answer: Today's batteries are more durable, have high power-to-weight ratios and lighter cases.

5. Question: _____ ?

Answer: The acid is a mixture of 25 percent water and 75 percent sulfuric acid (H2SO4).

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **series; output; which; discharges; greater.**

A 12-volt battery has six «cells», each of _____ contains 9 to 20 positive and negative plates. The _____ the number of plates, the higher the power output (measured in amps) of the battery. Each cell produces 2.11 volts, so when all six cells are connected together in_____ , the battery's total _____ is actually 12.66 volts. As a battery _____ , sulfate combines chemically with the positive and negative plates.

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Material	Processes
Example: lead in an acid mixture reacts to produce			an electrical pressure
the battery also serves as			
a slow chemical reaction will cause			
sulfate combines chemically with			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«An automotive lead-acid battery».
«Battery energy».
«Electrical energy on vehicles».

T e x t 5

NEW CELL DESIGNS

THE READING MODULE

Read the text:

Many batteries today contain a «gel» electrolyte. There is no free liquid inside the battery. The acid is contained in Absorbent Glass Mat (AGM) separators between the plates. The separators hold the acid much like a paper towel soaks up water, making the battery spill-proof even if the case is punctured. This also means a battery with AGM separators can be shipped by normal means (no spillage) and installed in any position. AGM separators provide extra cushioning and are more resist to vibration damage (a leading cause of battery failure).

Some premium batteries also use a new type of «spiral wound» cell construction instead of flat plates. This allows a greater surface area for higher power density. The six battery cells are arranged like beverage cans in a six-pack. The result is a very compact, efficient design that delivers more cranking amps during the initial three to five seconds of cranking. The spiral wound cells also produce a slightly higher voltage that raises the battery's overall voltage output by 15 percent for added cranking power. The tightly wound spiral cells typically hold a charge longer than flat plate cells, which means the battery can sit for months without being used and still crank an engine. The spiral wound construction also offers improved durability making this type of battery ideal for rugged-use applications.

New high-voltage batteries (up to 274 volts) are also being used in hybrid vehicles. In the first-generation Toyota Prius, a stack of 38 7.2- volt Nickel Metal Hydride (NHM) batteries are combined in series to produce the power needed to run the car’s electric motor and operate the engine stop-start system. The second generation Prius uses a smaller 28 NHM battery pack with a voltage rating of only 201 volts, but its amperage output is actually higher than the previous battery. These are very expensive batteries and are covered by an extended warranty. Hybrid replacement batteries are not yet available in the aftermarket - but that will eventually change as more and more hybrid vehicles go into production. Both Ford and GM have hybrids coming (though in limited numbers), and Toyota and Honda are ramping up their production.

Lithium-Ion Car Battery

For automotive applications, Valence Technology Inc. has introduced a new lithium-ion car battery. The «U-Charge» system's patented «Saphion» Lithium-ion technology offers twice the amp capacity of an ordinary battery of the same size, and one third of the weight. It also charges faster and lasts up to four times longer than a lead-acid battery says the company. The battery can be used as a direct replacement for

an ordinary car battery. Saphion technology utilizes a phosphate-based cathode material in place of metal-oxide materials that are typically used in Lithium-ion batteries. Saphion technology is chemically and thermally stable, making it safer than lead-acid batteries.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

an extended warranty; case; deliver; density; flat; free liquid; metal-oxide material; safe; stop-start system; weight

Exercise 2. Answer the questions:

1.What do batteries today contain a «gel» electrolyte for?
2. What do premium batteries also use instead of flat plates?
3. What does the spiral wound construction also offer?
4. How are Metal Hydride (NHM) batteries combined?
5. Why has a new lithium-ion car battery been introduced?

Exercise 3. Match the left part with the right:

1. Many batteries today contain	a) extra cushioning and are more resist to vibration damage.
2. AGM separators provide	b) an ordinary battery of the same size.
3. The tightly wound spiral cells typically hold	c) a «gel» electrolyte.
4. Lithium-ion technology offers twice the amp capacity of	d) a charge longer than flat plate cells.

Exercise 4. Open the brackets choosing the right words:

Some premium batteries also (use/make) a new type of «spiral-wound» cell construction instead of flat plates. This allows a (smaller/greater) surface area for higher power density. The six battery cells are (arranged/broken) like beverage cans in a six-pack. The result is a very compact, efficient design that delivers more cranking amps during the (final/initial) three to five seconds of cranking.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **electric motor; output; replacement; cover** using the suggested words and expressions as in example:

puncture discharge; insulation; increase in current; failure; electrostatic stress **Example: Puncture** happens, when disruptive discharge occurs through insulation involving a sudden and large increase in current through the insulation due to complete failure under electrostatic stress.
electric motor convert; electric energy; mechanical energy; forces; magnetic fields; current-carrying conductors
output current; voltage; power; driving force; a circuit; device; deliver
replacement filling; again; supplying; used up

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: The six battery cells are arranged like beverage cans in a six-pack.
2. Question: _____ ?
Answer: The spiral wound construction also offers improved durability.
3. Question: _____ ?
Answer: Hybrid replacement batteries are not yet available in the aftermarket.
4. Question: _____ ?
Answer: Lithium-ion technology offers twice the amp capacity of an ordinary battery of the same size.

THE WRITING MODULE

III. Writing exercises:

Exercise 1**.** Complete the sentences with the suggested words: **use; allows; arranged; delivers; raises.**

Some premium batteries also _____ a new type of «spiral wound» cell construction instead of flat plates. This _____ a greater surface area for higher power density. The six battery cells are _____ like beverage cans in a six-pack. The result is a very

compact, efficient design that _____ more cranking amps during the initial three to five seconds of cranking. The spiral wound cells also produce a slightly higher voltage that _____ the battery's overall voltage output by 15 percent for added cranking power.

Exercise 2**.** Fill in the table with words and expressions from the text:

	Material	Place	Processes
Example: Many batteries today contain	a «gel» electrolyte	-	-
The acid is contained in			
Spiral wound cells also produce			
Saphion technology utilizes			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«A battery with AGM separators».
«Premium batteries».
«Nickel Metal Hydride (NHM) batteries».
«A new lithium-ion car battery».

T e x t 6

CAMSHAFTS

THE READING MODULE

Read the text:

One of the most important components in any engine is the camshaft. Whether the camshaft is in a pushrod engine or an overhead cam engine, it controls the opening and closing of the valves. This, in turn, controls the flow of air and fuel into and out of the engine which determines engine performance, fuel economy and emissions.

In pushrod engines, the camshaft is either chain or gear driven off the crankshaft. In OHC engines, the camshaft may be belt or chain driven from the crankshaft or an intermediate shaft. The drive ratio is always 1:2 so the cam turns at half the speed of the crankshaft. This is because the crankshaft in a four stroke engine makes two complete

revolutions for every power cycle (intake stroke, compression stroke, power stroke and exhaust stroke).

Cam-related problems can occur for a variety of reasons. As an engine accumulates miles, the timing chain stretches. The added slack in the chain has a retarding effect on cam timing, which reduces compression and torque. It can also retard ignition timing if the distributor is cam-driven. Most OHC engines that use a chain drive have some type of automatic chain tensioning device, but pushrod engines do not. Consequently, the timing chain and gear set often need to be replaced in high-mileage pushrod engines.

In OHC engines with belt-driven cams, the main concern is belt failure. If the belt snaps, the cam stops turning and the engine quits. Some valves will be held in the open position, which may result in bent valves and/or damaged pistons if the engine does not have enough clearance between the pistons and valves to freewheel.

To minimize the risk of such damage, most vehicle manufacturers recommend replacing OHC timing belts at specific mileage intervals for preventive maintenance. On older OHC engines, 60,000 miles is the typical replacement interval. On newer OHC engines, it is 100,000 miles.

Cam failures can occur if there are lubrication problems in the engine. Lifters create a lot of pressure and friction on the cam lobes, so the lobes and cam bearings must receive lots of oil. If oil pressure is low or the oil is dirty, the cam may suffer accelerated lobe wear and ultimately lobe failure resulting in a dead cylinder (no valve action). This type of cam damage can also be caused by using the wrong viscosity motor oil. In overhead cam engines, it is a long way from the oil pump to the top of the cylinder head. On cold mornings when the oil is thick, it can take quite a few seconds for adequate oil pressure to reach the cam. That is why most vehicle manufacturers recommend using 5W-30 oil rather than 10W-30 or 10W-40 for cold weather driving.

Cam breakage or seizure is another problem that can occur in OHC engines. The cause may be inadequate lubrication but in many instances it is caused by head warpage. When an OHC engine gets too hot, the cylinder head tends to swell and bulge up in the middle. This changes the alignment of the cam bores in the head which may cause the cam to bend, bind, seize or break. If an overhead cam does not turn freely in the head then the belt and cam followers are removed, either the cam is bent or the head is warped and needs to be straightened and/or align bored.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

belt-driven; camshaft; chain; compression stroke; exhaust stroke; gear; intake stroke; lubrication; power stroke; pushrod

Exercise 2. Answer the questions:

1.What is one of the most important components in any engine?
2.Where is the camshaft either chain or gear driven off the crankshaft?
3.Why can cam-related problems occur?
4. When can cam failures occur?

Exercise 3. Match the left part with the right:

1. The camshaft is either chain or	a) a retarding effect on cam timing.
2. The added slack in the chain has	b) replacing OHC timing belts at specific mileage intervals.
3. If the belt snaps, the cam	c) gear driven off the crankshaft.
4. To minimize the risk of such damage, most vehicle manufacturers recommend	d) stops turning and the engine quits.

Exercise 4. Open the brackets choosing the right words:

On cold mornings when the oil is (thin/thick), it can take quite a few seconds for adequate oil pressure to reach the cam. That is why most vehicle manufacturers (recommend/deny) using 5W-30 oil rather than 10W-30 or 10W-40 for (cold/hot) weather driving.

THE SPEARING MODULE

II. Speaking exercises:

Exercise 1. Describe **intake stroke; compression stroke**; **exhaust stroke** using the suggested words and expressions as in example:

Camshaft rotating; shaft; cam; attached **Example:** A **camshaft** is a rotating shaft to which a cam is attached.
intake stroke fluid admission phase; travel; reciprocating piston; cylinder mechanism; engine; pump; compressor
compression stroke phase; positive displacement engine; compressor; motion; piston; compress; fluid; cylinder
exhaust stroke engine; pump; compressor; expel; fluid; cylinder

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: As an engine accumulates miles, the timing chain stretches.

2. Question: _____ ?

Answer: The timing chain and gear set often need to be replaced in high-mileage pushrod engines.

3. Question: _____ ?

Answer: To minimize the risk of such damage, most vehicle manufacturers recommend replacing OHC timing belts at specific mileage intervals

4. Question: _____ ?

Answer: Cam breakage or seizure is another problem that can occur in OHC engines.

5. Question: _____ ?

Answer: When an OHC engine gets too hot, the cylinder head tends to swell and bulge up in the middle.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **receive; suffer; are.**

Cam failures can occur if there _____ lubrication problems in the engine. Lifters create a lot of pressure and friction on the cam lobes, so the lobes and cam bearings must _____ lots of oil. If oil pressure is low or the oil is dirty, the cam may _____ accelerated lobe wear and ultimately lobe failure resulting in a dead cylinder (no valve action).

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Material	Processes
Example: Most OHC engines have some type of	automatic chain tensioning device	-	-
most vehicle manufacturers recommend replacing			
the cam may suffer			
Cam breakage or seizure is another problem that			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Pushrod engines».
«Cam-related problems».
«Cam failures».
«Cam breakage».

T e x t 7

DIRECT FIT OR UNIVERSAL MUFFLERS?

THE READING MODULE

Read the text:

Most premium-quality performance mufflers and pipes today are made of stainless steel (usually aircraft-quality T-304), but there are lesser quality grades of stainless that sell for less. Aluminized steel is another option, but it does not have the durability of stainless. Even so, aluminized steel is much better than plain, uncoated or painted steel. Most performance pipes are formed with mandrel bends which do not narrow the diameter of the pipe where it curves. This reduces unwanted restrictions and keeps the exhaust flowing freely. Most premium mufflers and systems are also plasma or TIG welded to maintain the strength and corrosion resistance of the stainless steel. Some manufacturers also use a process called bulge forming or hydroforming to form steel sheets into molded shapes using extremely high fluid pressure.

Performance mufflers are available in both direct-fit and (or either direct-fit or) universal configurations. You will find the greatest selection in universal products, which can be adapted and made to fit almost any vehicle. But the main drawback of one-size-fits-all mufflers is that they sometimes require cutting and welding pipes, and fabricating hangers and mounts.

When the stock muffler is removed, the existing pipe may have to be cut, shortened or lengthened. If the pipes are getting weak, they may also have to be replaced to complete the installation. New hangers are often necessary to support the muffler, or existing hangers may have to be repositioned to provide proper support and keep the system from flexing or rattling. Clearance may be another issue, especially with large oversized muffler cans that are not the same size, shape or length as the original muffler.

Making modifications to a stock exhaust system raises another issue. It may complicate matters if you ever want to go back to a stock muffler. This may not seem like much of an issue when you are installing the muffler or exhaust system. But if and when you sell the vehicle, you may want to remove the parts you installed and replace

them with the original parts. So the fewer modifications that have to be made to install a custom universal-fit muffler, the better.

Direct-fit mufflers usually do not require modifications or changes because they are designed to replace the stock muffler perfectly. Most are a simple bolt-in installation that connect to existing pipes and have mounts that line up with the stock hangers. The major drawback with direct-fit custom mufflers is limited availability for less popular models.

Sound quality is something that is harder to control with universal-fit mufflers than direct-fit mufflers, which have been engineered for a specific vehicle application. Different engines sound differently and produce different frequencies and harmonics in their exhaust systems. So don't expect a universal muffler to sound exactly the same on different vehicles. At the same time, some performance mufflers are tunable in that they have removable baffles. You can change the sound by adjusting or removing the baffles.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

muffler; quality grade; option; painted steel; mandrel bend; plasma; corrosion resistance; hanger; support; modification; complicate; sound quality; vehicle; removable baffle

Exercise 2. Answer the questions:

1. What are most premium-quality performance mufflers and pipes made of today?
2. How are performance pipes formed?
3. What is the main drawback of one-size-fits-all mufflers?
4. What happens when the stock muffler is removed?

Exercise 3. Match the left part with the right:

1. Most premium-quality performance mufflers and pipes today	a) in both direct-fit or universal configurations.
2. Aluminized steel	b) are made of stainless steel.
3. Performance mufflers are available	c) raises another issue.
4. Making modifications to a stock exhaust system	d) is much better than plain, uncoated or painted steel.

Exercise 4. Open the brackets choosing the right words:

Direct-fit mufflers usually do not require modifications or changes because they are (painted /designed) to replace the stock muffler perfectly. Most are a simple bolt-in installation that connect to existing pipes and have (mounts/tables) that line up with the

stock hangers. The major drawback with direct-fit custom mufflers is (limited/free) availability for less popular models.

SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **muffler; stainless alloy; welding; clearance; installation** using the suggested words and expressions as in example:

muffler device; to deaden; the noise; produce; escaping gases; vapors **Example:** A **muffler** is a device to deaden the noise produced by escaping gases or vapors.
stainless alloy corrosion-resistant iron-chromium alloys; containing 10% or more chromium; nickel; silicon; molybdenum; tungsten; niobium; known as stainless steel (SS)
welding joining; two metals; heat; to melt; to fuse; with or without filler metal
clearance piston-and-cylinder mechanism; the space; the cylinder; at dead-center position; toward the end of the cylinder
installation procedures; setting up; equipment; use or service

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: Most performance pipes are formed with mandrel bends which do not narrow the diameter of the pipe where it curves.

2. Question: _____ ?

Answer: Performance mufflers are available in both direct-fit and (or either direct-fit or) universal configurations.

3. Question: _____ ?

Answer: When the stock muffler is removed, the existing pipe may have to be cut, shortened or lengthened.

4. Question: _____ ?

Answer: Direct-fit mufflers usually do not require modifications or changes because they are designed to replace the stock muffler perfectly.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **connect; require; is.**

Direct-fit mufflers usually do not _____ modifications or changes because they are designed to replace the stock muffler perfectly. Most are a simple bolt-in installation that _____ to existing pipes and have mounts that line up with the stock hangers. The major drawback with direct-fit custom mufflers _____ limited availability for less popular models.

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Materials	Processes
Example: pipes today are made of		stainless steel	
most performance pipes are formed with			
Manufactures also use			
new hangers are often necessary to support			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«A bulge forming or a hydroforming process».
«The main drawback of one-size-fits-all mufflers».
«Making modifications to a stock exhaust system».
«Direct-fit mufflers».

T e x t 8

SERVICING THE ENGINE COOLING SYSTEM

THE READING MODULE

Read the text:

Did you know that up to a third of the heat energy produced by an internal combustion engine ends up as waste heat in the cooling system? A gallon of gasoline produces about 19,000 to 20,000 BTUs of heat energy when it is burned, which is enough to boil over 120 gallons of water! So the two or so gallons of coolant that

circulate within the typical automotive cooling system have to carry away a lot of heat. The radiator also has to be fairly efficient at getting rid of the heat, too, otherwise the BTUs will start to back up and make the engine overheat. An efficient cooling system, therefore, requires several things: an adequate supply of coolant, an efficient heat exchanger a fan to pull air through the radiator at low speeds, a water pump to keep the coolant moving, and a thermostat to regulate the operating temperature of the engine for good performance, fuel economy and emissions. The coolant must also have the right mix of water and antifreeze to provide adequate freezing and boiling protection, and the proper amount of corrosion inhibitors to protect against rust, oxidation and electrolysis. To keep the cooling system in good operating condition, it is important to check the level, strength and condition of the coolant on a regular basis - and to replace or recycle the coolant before the protective additives are entirely depleted.

According to the U.S. Department of Transportation, cooling system failure is the leading cause of mechanical breakdowns on the highway. And according to numerous aftermarket surveys that have been performed over the years, coolant neglect is one of the leading causes of cooling system breakdowns.

Check the Level. One reason for checking the coolant level regularly is to detect leaks that can lead to overheating. The level should be checked at the coolant reservoir, not the radiator, because the radiator will siphon coolant from the reservoir when it is needed.

Most vehicles will lose a little coolant over time due to evaporation from the reservoir. But a significant loss of coolant in a relatively short period of time usually signals a leak, a radiator cap that is not holding pressure or a cooling system that is running too hot. Visually inspect the radiator, water pump, hoses, freeze plugs, etc. for external leaks, and then pressure test the radiator and cap to find out where the coolant is going. A tight system should hold the maximum rated pressure for at least two minutes with no drop in the gauge reading.

If you do not see any visible leaks and the system holds pressure, make sure the cap is good and has the correct pressure rating for the application (somebody may have replaced it with the wrong cap). Still cannot find where the coolant is going? Check the automatic transmission dipstick. A leaky ATF oil cooler loop in the radiator may be allowing ATF fluid and coolant to intermingle.

If the system does not hold pressure, you have found an internal leak. Now you have to figure out where. Check the level and appearance of the oil on the dipstick for coolant contamination in the crankcase. A higher-than-normal oil level and/or a foamy appearance to the oil or droplets of coolant on the dipstick would tell you the engine has a leaky head gasket or cracked block. Coolant leaking into combustion chamber pasts the head gasket or through a crack in the cylinder head will often foul the spark plug and contaminate the oxygen sensor. The silicate corrosion inhibitors in conventional antifreeze will poison the O_2 sensor, so plan on replacing the sensor(s) if this has happened.

If no leaks are found, the loss of coolant may be due to long-term neglect or a temporary episode of overheating. Has your engine overheated recently? A defective

cooling fan, slipping drive belt, exhaust restriction (plugged converter) or even overloading the engine may have caused the system to get too hot and boil over.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

additive; coolant; crankcase; evaporation; gauge reading; head gasket; heat exchanger; internal combustion engine; leak; loop; rust; spark plug; overheating

Exercise 2. Answer the questions:
1. How much heat energy does a gallon of gasoline produce when it is burned?
2. What does an efficient cooling system require?
3. What is needed to keep the cooling system in good operating condition?
4. What is the reason for checking the coolant level regularly?

Exercise 3. Match the left part with the right:

1. A tight system should hold the maximum rated pressure for at least	a) have found an internal leak.
2. If the system does not hold pressure, you	b) evaporation from the reservoir.
3. Most vehicles will lose a little coolant over time due to	c) the O_2 sensor.
4. The silicate corrosion inhibitors in conventional antifreeze will poison	d) two minutes with no drop in the gauge reading.

Exercise 4. Open the brackets choosing the right words:

If no leaks are (lost/found), the loss of coolant may be due to long-term neglect or a temporary episode of overheating. Has your engine (overheated/cooled) recently? A defective cooling fan, slipping drive belt, exhaust restriction or even overloading the engine may have (dropped/caused) the system to get too hot and boil over.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **heat exchanger; pump; additive**; **radiator** using the suggested words and expressions as in example:

combustion burning; gas; liquid; solid; the fuel; heat; light **Example: Combustion** is the process when the burning of gas, liquid, or solid, in which the fuel is oxidized, evolves heat and often light.
heat exchanger device; an automobile radiator; transfer; heat; fluid; environment
pump machine; to draw; fluid; an entrance port; to force; an exhaust port
additive substance; to add; to strengthen; for the purpose of improving; performance; product
radiator any of numerous devices; units; surfaces; to emit heat; objects in the space; installed

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: The radiator also has to be fairly efficient at getting rid of the heat.
2. Question: _____ ?
Answer: The coolant must also have the right mix of water and antifreeze to provide adequate freezing and boiling protection.
3. Question: _____ ?
Answer: To keep the cooling system in good operating condition, it is important to check the level, strength and condition of the coolant on a regular basis.
4. Question: _____ ?
Answer: The level should be checked at the coolant reservoir, not the radiator, because the radiator will siphon coolant from the reservoir when it is needed.

THE WRITING MODULE

III.Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **is; causes; been.**

According to the U.S. Department of Transportation, cooling system failure ____ the leading cause of mechanical breakdowns on the highway. And according to numerous aftermarket surveys that have _____ performed over the years, coolant neglect is one of the leading _____ of cooling system breakdowns.

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Systems	Processes
Example: heat energy is produced by		an internal combustion engine	
the two or so gallons of coolant have to carry away			
A leaky ATF oil cooler loop in			
coolant level should be checked			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«An efficient cooling system».
«Checking the coolant level».
«Loss of coolant».

T e x t 9

RADIATORS

THE READING MODULE

Read the text:

Maintaining the coolant will go long ways (or go a long way) toward prolonging the life of the radiator and other components in the cooling system. But if the coolant is not maintained, corrosion will eventually take over and attack the innards of the system. The most vulnerable components are the radiator and heater core, especially lead-soldered copper/brass heat exchangers in older vehicles. But aluminum radiators and heater cores are vulnerable to attack, too.

Lack of maintenance can also allow a buildup of rust and scale that can clog a radiator or heater core. Heat exchangers with extremely small passageways are especially susceptible to this kind of problem. Once clogged, heat exchangers are difficult to clean and replacement is usually necessary.

The average service life of an OEM copper/brass radiator is six to 10 years, and eight to 12 for aluminum. But even with good care, radiators can fail for a variety of reasons including vibration, mechanical stress and physical damage. Fatigue cracks can occur where the inlet and outlet fittings connect to end tanks, along tank/tube header connections, or where the radiator support brackets attach to the radiator.

Excessive heat can kill a radiator too. Ones with plastic end tanks can be damaged by steam erosion if the coolant level becomes low and the engine overheats. White deposits on the inside of the plastic tank would indicate steam damage.

Replacement radiators are available in various styles and materials. What is important here is making sure the replacement radiator cools as well (or better) than the original. Compare the BTU ratings to make sure the replacement can handle the heat. Some "value priced" replacement radiators cut corners to reduce cost, and may not cool as well as the original. For normal driving, this might not be a problem but under heavy load or during unusually hot weather it might increase the risk of overheating.

When it comes to cooling capacity, it may be a good idea to upgrade - especially if a vehicle spends a lot of time idling in traffic during hot weather, pulls a trailer or is driven off-road. Aftermarket "heavy-duty" or performance radiators typically have additional rows of tubes, increased thickness and/or a more efficient fin and tube design to improve cooling performance.

For some applications, you may also have a choice between an aluminum or copper/brass replacement radiator or heater core. Aluminum is the most common material for newer applications (almost 90% of all new vehicles), while copper/brass is the most common material for older cars and trucks. Copper/brass was used almost exclusively up until 1980s when aluminum's weight-saving and environmental advantages (no lead solder) brought it to the forefront. Some say copper/brass cools better than aluminum, but cooling efficiency depends more on the design of the radiator than the materials in it. The safest approach is to use the same type of heat exchanger as the original.

When a radiator is replaced, compare the width, height and thickness to see if any modifications will be needed to make it fit (hopefully, none will be needed). Aftermarket radiators may not always be an exact match with the original because of consolidation (especially if a copper/brass radiator is being replaced with one made of aluminum or vice versa). But as long, as the size and location of the hose connections are the same or similar, it should create no installation problems. On some newer vehicles, the radiator is part of a «cooling module» that includes the A/C condenser and fan. Some of these can be difficult to remove and may have to come out from the bottom rather than the top. Separating the radiator from the other components may also be a chore. And if it is a really new vehicle, the radiator may not yet be available as a separate item, which means you have to replace the entire module at added expense.

Other cooling system items that may also need to be replaced when changing a radiator include the upper and lower radiator hoses, heater hoses, hose clamps, water pump, fan clutch (on older vehicles with pump driven fans) and drive belts. The old radiator cap should not be reused unless it has passed a pressure test. In fact, most radiator manufacturers say a new cap should always be used if the radiator is replaced. The new cap must have the same pressure rating as the original.

If the engine overheated, the thermostat also should be replaced as a precaution to eliminate the risk of a repeat boil over. Overheating frequently damages the wax element inside the thermostat. You also should check the coolant sensor to make sure it

has not been damaged. Inspect the thermostat housing and replace it if it is badly corroded, warped or cracked.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

coolant; corrosion; heater core; vulnerable; vibration; fatigue crack; trailer; truck; exact match; hose connection; fan clutch; pressure test

Exercise 2. Answer the questions:

1. What action will go a long way toward prolonging the life of the radiator?
2. When does corrosion eventually take over and attack the innards of the system?
3. Why are heat exchangers difficult to clean?
4. When should a new cap be used?

Exercise 3. Match the left part with the right:

1. Lack of maintenance can also allow	a) rows of tubes, increased thickness and/or a more efficient fin and tube design to improve cooling performance.
2. The most vulnerable components are the radiator and heater core, especially	b) a buildup of rust and scale that can clog a radiator or heater core.
3. Aftermarket «heavy-duty» or performance radiators typically have additional	c) part of a «cooling module» that includes the A/C condenser and fan.
4. On some newer vehicles, the radiator is	d) lead-soldered copper/brass heat exchangers in older vehicles.

Exercise 4. Open brackets choosing the right words:

On some newer vehicles the radiator (are/is) part of a «cooling module» that includes the A/C condenser and fan. Some of these can (be/been) difficult to remove and may have to come out from the bottom rather than the top. Separating the radiator from the other components may also (are/be) a chore. And if it is a really new vehicle, the radiator may not yet be available as a separate item, which means you (has/have) to replace the entire module at added expense.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **coolant; core; heat exchanger**; **service life** using the suggested words and expressions as in example:

coolant substance; fluid; cooling; part; device; heat; to generate **Example: Coolant** is a substance, ordinarily fluid, used for cooling any part of a device in which heat is generated.
core central part; a body; structure
heat exchanger device; automobile radiator; to transfer; heat; fluid; environment
service life length of time; a machine; tool; apparatus; device; be operated or used; economically; breakdown

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: The average service life of an OEM copper/brass radiator is six to 10 years.

2. Question: _____ ?

Answer: Excessive heat can kill a radiator, too.

3.Question: _____ ?

Answer: For some applications, you may also have a choice between an aluminum or copper/brass replacement radiator or heater core.

4.Question: _____ ?

Answer: Aftermarket radiators may not always be an exact match with the original because of consolidation.

5. Question:_____ ?

Answer: The old radiator cap should not be reused unless it has passed a pressure test.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **make; damages; corroded; replaced.**

If the engine overheated, the thermostat also should be _____ as a precaution to eliminate the risk of a repeat boil over. Overheating - frequently _____ the wax element inside the thermostat. You also should check the coolant sensor to _____ sure it has not been damaged. Inspect the thermostat housing and replace it if it is badly_____, warped or cracked.

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Systems	Processes
Example: On some newer vehicles, the radiator is part of	a «cooling module» that includes the A/C condenser and fan.	-	-
Excessive heat			
The most vulnerable components are			
Lack of maintenance can also allow			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Maintaining the coolant».
«The radiator and heater core».
«Aftermarket «heavy-duty» or performance radiators».

T e x t 10

BRAKE SYSTEM BASICS

THE READING MODULE

Read the text:

Brake parts account for a substantial portion of most parts store sales today, and should continue to do so in the future. Why? Because many parts in the brake system are high-wear items, that have to be replaced every few years. When you add up all of the things that can go wrong with brakes, it's a wonder there aren't more brake-related

accidents. Fortunately, most people realize how important good brakes are for safe driving and usually have the brakes repaired when a problem occurs.

Disc brake pads and drum brake shoes are typically replaced several times during a vehicle's life. Most vehicles still have disc brakes in the front and drums in the rear, but a growing number have disc brakes both front and rear. Either way, the front brakes work harder than the rears. Consequently, the front linings are usually replaced two or three times as often as the rear linings.

Brake pads and shoes are sold in matched axle sets (both fronts and (or either fronts or) both rears) and should be installed in matched sets on the vehicle. Many vehicles are very sensitive to the type of friction material in the linings so you should recommend a premium grade of replacement linings that are the same basic type (or better) of friction material as the OE linings to maintain the same feel, wear and stopping power.

There's a wide range of friction materials used in brake linings today including semi-metallic, ceramic, low-metallic and non-/_asbestos organic. What's more, many of the friction materials are «application engineered» for specific vehicle applications. When choosing linings, consider how a vehicle is driven and follow the brake supplier's guidelines as to what type of linings would be best for the application.

Ceramic-based friction materials have become popular in recent years because of their stable braking characteristics, low-dust qualities and rotor-friendly nature. Ceramics are also quieter than semi-met and longer lived than most non-/_asbestos organic friction materials. If a vehicle was originally equipped with ceramic pads, the replacement pads should also be ceramic. Vehicles originally equipped with semi-metallic pads can also be upgraded to ceramic pads in many instances, especially if noise and/or rotor wear have been a problem. Severe-duty users should stick with semi-metallic pads because of their ability to withstand extreme braking temperatures.

Rotors and drums may need to be resurfaced or replaced when the brakes are relined. Some minor grooving of the friction surface is normal, but if the surface is deeply grooved or heavily worn, resurfacing or replacement will be required.

Excessive runout, uneven wear and warpage are other problems that can afflict rotors. Variations in thickness can cause the brake pedal to pulsate, which may also be felt in the steering wheel. Resurfacing the rotors will make them flat again, but hard spots tend to come back after a few thousand miles. The best cure, therefore, is to replace the rotors.

Rotors and drums have wear limits for safety reasons. These parts must have a certain minimum thickness to maintain their integrity and to cool the brakes properly. If the metal is too thin, the rotor or drum may fail. Rotor thickness must be measured with a micrometer before a rotor is resurfaced or reused. The inside diameter of drums must be measured with a drum gauge. If the diameter exceeds specs, the drum must be replaced. Drums or rotors that are cracked or damaged must also be replaced.

Calipers apply the brakes in a disc brake system, while wheel cylinders perform the same job in drum brakes. Both use pistons and hydraulic pressure to apply the brakes. The main problems here are fluid leaks due to seal wear or damage, and piston sticking due to corrosion.

Many experts recommend rebuilding or replacing calipers and wheel cylinders when the brakes are relined in high-mileage vehicles, even if the original parts are not leaking or sticking. Why? To reduce the risk of a comeback. Calipers and wheel cylinders are the lowest point in the hydraulic system and tend to collect moisture and sediment. As a result, internal corrosion often leaves pistons and bores pitted and rough.

Calipers are sold as bare units (new or remanufactured) or as «loaded» assemblies with new pads, shims and hardware. Loaded calipers provide everything your customer needs in one box and with one part number, which makes for easier installation.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

brake; drum; linings; axle set; friction; wear; low-dust quality; surface; runout; steering wheel; caliper; fluid leak; comeback; internal corrosion

Exercise 2. Answer the questions:

1. What do brake parts account for?
2. Why do most people realize how good brakes are important for safe driving?
3. What kind of brakes do most vehicles still have?
4. What kind of friction materials are used in brake linings today?

Exercise 3. Match the left part with the right:

1. Brake pads and shoes are sold in matched axle sets and should be installed	a) popular in recent years because of their stable braking characteristics.
2. Disc brake pads and drum brake shoes are typically replaced	b) the brakes are relined.
3. Ceramic-based friction materials have become	c) several times during a vehicle's life.
4. Rotors and drums may need to be resurfaced or replaced when	d) in matched sets on the vehicle.

Exercise 4. Open brackets choosing the right words:

Excessive runout, uneven wear and warpage (are/been) other problems that can afflict rotors. Variations in thickness can (cause/to cause) the brake pedal to pulsate, which may also be felt in the steering wheel. Resurfacing the rotors will (make/makes) them flat again, but hard spots tend to come back after a few thousand miles. The best cure, therefore, (are/is) to replace the rotors.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **drum; pad; safety**; **seal** using the suggested words and expressions as in example:

drum hollow; solid; cylinder; barrel; act; an exterior entity; drum brake; hoisting drum **Example:** A **drum** is a hollow or solid cylinder or barrel that acts on, or is acted upon by, an exterior entity, such as the drum in a drum brake. Also known as hoisting drum.
pad layer; material; use; a cushion; protection
safety methods; techniques; avoiding; accident; disease
seal device; system; create; non-/_leaking; mechanical or process-system elements; gaskets; mechanical; rotating members; pump shafts; liquid; to prevent; gas entry; loss; a gas-liquid processing

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
   Answer: Many experts recommend rebuilding or replacing calipers and wheel cylinders when the brakes are relined in high-mileage vehicles.
2. Question: _____ ?
   Answer: Calipers apply the brakes in a disc brake system, while wheel cylinders perform the same job in drum brakes.
3. Question: _____ ?
   Answer: Rotors and drums have wear limits for safety reasons.
4. Question: _____ ?
   Answer: Ceramic-based friction materials have become popular in recent years because of their stable braking characteristics.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **sets; wear; friction.**

Brake pads and shoes are sold in matched axle _____ (both fronts and /or either fronts or) both rears) and should be installed in matched sets on the vehicle. Many vehicles are very sensitive to the type of _____ material in the linings so you

should recommend a premium grade of replacement linings that are the same basic type (or better) of friction material as the OE linings to maintain the same feel, _____ and stopping power.

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Systems	Processes
Example: Most vehicles still have	disc brakes in the front and drums in the rear		
Many vehicles are very sensitive to			
Ceramics are also quieter than			
Rotors and drums may need to be resurfaced or replaced when			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Parts of the brake system».
«Disc brake pads and drum brake shoes».
«Ceramic-based friction materials».
«Replacing calipers and wheel cylinders».

UNIT 2

ELECTRICAL ENGINEERING

T e x t 1

ELECTRICAL MACHINES

THE READING MODULE

Read the text:

Electric machine is a machine that converts electrical energy into mechanical energy. When an electric current is passed through a wire loop that is in a magnetic field, the loop will rotate and the rotating motion is transmitted to a shaft, providing useful mechanical work. The traditional electric motor consists of a conducting loop that is mounted on a rotatable shaft. Current fed in by carbon blocks, called brushes, enters the loop through two slip rings. The magnetic field around the loop, supplied by an iron core field magnet, causes the loop to turn when current is flowing through it.

In an alternating current (AC) motor, the current flowing in the loop is synchronized to reverse direction at the moment when the plane of the loop is perpendicular to the magnetic field and there is no magnetic force exerted on the loop. Because the momentum of the loop carries it around until the current is again supplied, continuous motion results. In alternating current induction motors the current passing through the loop does not come from an external source but is induced as the loop passes through the magnetic field.

In a direct current (DC) motor, a device known as a split ring commutator switches the direction of the current each half rotation to maintain the same direction of motion of the shaft. In any motor the stationary parts constitute the stator, and the assembly carrying the loops is called the rotor, or armature. As it is easy to control the speed of direct-current motors by varying the field or armature voltage, these are used where speed control is necessary. The speed of AC induction motors is set roughly by the motor construction and the frequency of the current; a mechanical transmission must therefore be used to change speed. In addition, each different design fits only one application. However, AC induction motors are cheaper and simpler than DC motors. To obtain greater flexibility, the rotor circuit can be connected to various external control circuits. Most home appliances with small motors have a universal motor that runs on either DC or AC. Where the expense is warranted, the speed of AC motors is controlled by employing special equipment that varies the power-line frequency, which in the United States is 60 hertz (Hz), or 60 cycles per second. Brushless DC motors are

constructed in a reverse fashion from the traditional form. The rotor contains a permanent magnet and the stator has the conducting coil of wire. By the elimination of brushes, these motors offer reduced maintainance, no spark hazard, and better speed control. They are widely used in computer disk drives, tape recorders, CD drives, and other electronic devices. Synchronous motors turn at a speed exactly proportional to the frequency. The largest motors are synchronous motors with DC passing through the rotor.

Generator in electricity is a machine used to change mechanical energy into electrical energy. It operates on the principle of electromagnetic induction, discovered by Michael Faraday. When a conductor passes through a magnetic field, a voltage is induced across the ends of the conductor. The generator is simply a mechanical arrangement for moving the conductor and leading the current produced by the voltage to an external circuit, where it actuates devices that require electricity. In the simplest form of generator the conductor is an open coil of wire rotating between the poles of a permanent magnet. During a single rotation, one side of the coil passes through the magnetic field first in one direction and then in the other, so that the induced current is alternating current , moving first in one direction, then in the other. Each end of the coil is attached to a separate metal slip ring that rotates with the coil. Brushes that rest on the slip rings are attached to the external circuit. Thus the current flows from the coil to the slip rings, then through the brushes to the external circuit. In order to obtain direct current , i.e., current that flows in only one direction, a commutator is used in place of slip rings.

The commutator is a single slip ring split into left and right halves that are insulated from each other and are attached to opposite ends of the coil. It allows current to leave the generator through the brushes in only one direction. This current pulsates, going from no flow to maximum flow and back again to no flow. A practical DC generator, with many coils and with many segments in the commutator, gives a steadier current. There are also several magnets in a practical generator. In any generator, the whole assembly carrying the coils is called armature, or rotor, while the stationary parts constitute the stator. Except in the case of the magneto, which uses permanent magnets,AC and DC generators use electromagnets. Field current for electromagnets is most often DC from an external source.

I. Reading exercises:

Exercise 1. Read and memorize using a dictionary:

wire loop, a rotatable shaft, iron core field magnet, armature, slip rings, home appliances, brushless DC motors, spark hazard, frequency, external circuit, coil

Exercise 2. Answer the questions:

1. What does the traditioal electric motor consist of?
2. Where does the current passing through the loop come from?
3. How is the speed of the AC induction motors set?
4. How are the brushless DC motors constructed?

Exercise 3. Match the left part with the right:

1. In a direct current (DC) motor, a device known as a split ring commutator	a) used to change mechanical energy into electrical energy.
2. Generator in electricity is a machine	b) switches the direction of the current each half rotation to maintain the same direction of motion of the shaft.
3. By the elimination of brushes	c) a separate metal slip ring that rotates with the coil.
4. Each end of the coil is attached to	d) these motors offer reduced maintainance, no spark hazard, and better speed control.

Exercise 4. Open brackets choosing the right words:

Because the momentum of the (loop/circuit) carries it around until the (current/voltage) is again supplied, continuous (motion/operation) results. In (alternating/direct) current induction motors the current passing through the loop does not come from an external (source/switch) but is induced as the loop passes through the magnetic field.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1. Describe **wire loop; alternating current (AC) motor; direct current (DC) motor;**
brushes; commutator using the suggested words and expressions as in example.

wire loop magnetic field, rotatong motion, mechanical work **Example:** When an electric current is passed through a wire loop that is in a magnetic field, the loop will rotate and the rotating motion is transmitted to a shaft, providing useful mechanical work.
alternating current (AC) motor loop, magnetic force, external source
direct current (DC) motor split ring commutator, stator, rotor, armature
brushes slip rings, external circuit, flow, through
commutator

single slip ring, coil, brushes, one direction

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: Electric machine is a machine that converts electrical energy into mechanical energy.

2) Question: _____ ?

Answer: Brushless DC motors are constructed in a reverse fashion from the traditional form.

3) Question: _____ ?

Answer: In any motor the stationary parts constitute the stator.

4) Question: _____ ?

Answer: There are also several magnets in a practical generator.

THE WRITING MODULE

III.Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **from, single, through, of, through, in, into**

The commutator is a _____ slip ring split ____ left and right halves that are insulated ____ each other and are attached to opposite ends ___ the coil. It allows current to leave the generator _____ the brushes ___ only one direction.

Exercise 2. Fill in the table with words and expressions from the text:

	Kinds of Motors	Price	Name of the Phisicist
Example: AC induction motors are	-	are cheaper and than DC motors.	
Most home appleances with small rotors			
It operates on the principle			
The larges motors are			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«AC and DC motors»

« Generator»

« Dynamo and alternator»

T e x t 2

THEORY OF ELECTRICAL ENGINEERING

THE READING MODULE

Read the text:

Electrical engineering , sometimes referred to as electrical and electronic engineering , is a field of engineering that deals with the study and application of electricity, electronics and electromagnetism. The field first became an identifiable occupation in the late nineteenth century after commercialization of the electric telegraph and electrical power supply. It now covers a range of subtopics including power, electronics, control systems, signal processing and telecommunications.

Electrical engineering may or may not include electronic engineering. Where a distinction is made, electrical engineering is considered to deal with the problems associated with large-scale electrical systems such as power transmission and motor control, whereas electronic engineering deals with the study of small-scale electronic systems including computers and integrated circuits. Alternatively, electrical engineers are usually concerned with using electricity to transmit energy, while electronic engineers are concerned with using electricity to transmit information.

Electrical engineering is a branch of engineering concerned with the practical applications of electricity in all its forms, including those of electronics. Electrical engineering deals with electric light and power systems and apparatuses; electronic engineering deals with wire and radio communication, the stored-program electronic computer, radar, and automatic control systems. The first practical application of electricity was the telegraph, in 1837. Electrical engineering emerged as a discipline in 1864 when James Clerk Maxwell summarized the basic laws of electricity in mathematical forms and predicted that radiation of electromagnetic energy would occur in a form that later became known as radio waves. The need for electrical engineers was not felt until the invention of the telephone (1876) and the incandescent lamp (1878).
Electrical engineering involves the design and testing of electronic circuits that use the properties of components such as resistors, capacitors, inductors, diodes and transistors to achieve a particular functionality. The tuned circuit, which allows the user of a radio to filter out all but a single station, is just one example of such a circuit.

Prior to the second world war, the subject was commonly known as radio engineering and basically was restricted to aspects of communications and radar, commercial radio and early television. Later, in post war years, as consumer devices began to be developed, the field grew to include modern television, audio systems, computers and microprocessors. In the mid to late 1950s, the term radio engineering gradually gave way to the name electronic engineering .

Electrical engineering has many sub-disciplines such as electronic engineering, computer engineering, power engineering and other disciplines are considered separate disciplines in their own right.

Power engineering deals with the generation, transmission and distribution of electricity as well as the design of a range of related devices.

Control engineering focuses on the modeling of a diverse range of dynamic systems and the design of controllers that will cause these systems to behave in the desired manner.

Electronic engineering involves the design and testing of electronic circuits that use the properties of components such as resistors, capacitors, inductors, diodes and transistors to achieve a particular functionality.

Microelectronics engineering deals with the design and micro fabrication of very small electronic circuit components for use in an integrated circuit or sometimes for use on their own as a general electronic component.

Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

application of electricity, deal with, invention, small-scale electronic systemp, filterout, consumer devices, related device, circuits

Exercise 2. Answer the questions:

1.What is electrical engineering?
2. What problem does electrical engineering deal with?
3. What was the first practical application if electricity?
4. When did electrical engineering emerge as a discipline?

Exercise 3. Match the left part with the right:

1. The field first became an identifiable occupation	a) until the invention of the telephone (1876) and the incandescent lamp (1878).
2. The need for electrical engineers was not felt	b) the generation, transmission and distribution of electricity as well as the design of a range of related devices.
3.Power engineering deals with	c) for use in an integrated circuit or sometimes for use on their own as a general electronic component.
4. Microelectronics engineering deals with the design and micro fabrication of very small electronic circuit components	d) in the late nineteenth century after commercialization of the electric telegraph and electrical power supply.

Exercise 4. Open brackets choosing the right words:

Control engineering (focuses\defocuses) on the modeling (on\of) a diverse range of dynamic systems and the design of controllers that will (cause\ make) these systems to behave in the desired manner.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1. Describe **electronic engineering; control engineering; microelectronics engineering; radio engineering; electronic circuit** using the suggested words and expressions as in example:

electronic engineering wire, electronic computer, automatic control systems **Example:** Electronic engineering deals with wire and radio communication, the stored-program electronic computer, radar, and automatic control systems.
control engineering modeling of, dynamic systems, controller
microelectronics engineering micro fabrication, integrated circuit, electronic component
radio engineering was restricted, radar, commercial radio, modern television, audio systems
radio engineering was restricted, radar, commercial radio, modern television, audio systems
electronic circuit design, testing properties of components, capacitors, diodes, transistors

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: Electrical engineering has many sub-disciplines such as electronic engineering, computer engineering, power engineering.

2) Question: _____ ?

Answer: Prior to the second world war, the subject was commonly known as radio engineering.

3) Question: _____ ?

Answer: The tuned circuit, which allows the user of a radio to filter out all but a single station, is just one example of such a circuit.

Question: _____ ?

4) Answer: Electrical engineers are usually concerned with using electricity to transmit energy.

THE WRITING MODULE

III.Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **of; with; of; for; on; for;**

Microelectronics engineering deals _____ the design and micro fabrication ____ very small electronic circuit components ____ use in an integrated circuit or sometimes ____ use ___ their own as a general electronic component.

Exercise 2**.** Fill in the table with words and expressions from the text:

	The Century	Name of the Phisicist	Purposes of Different Engineerings
Example: The field first became an identifiable occupation Electrical engineering emerged as a discipline in 1864	in the late nineteenth century	-	
Electronic engineers are concerned with			
Power engineering deals with			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Electrical engineering»

«Electronic engineering»

«Sub-disciplines of Electrical engineering»

T e x t 3

BASICS OF ELECTRICITY

THE READING MODULE

Read the text:

Current is the quantity of electrons passing a given point. The unit of current is the ampere. One ampere is 6,280,000,000,000,000,000 electrons passing a point in one second. Electrical current flows from a region of high charge or potential to a region of low potential. To make confusion worse there exist two notions about the direction in which current flows: Conventional Current assumes that current flows out of the positive terminal, through the circuit and into the negative terminal of the source. This was the convention chosen during the discovery of electricity. They were wrong! Electron flow is what actually happens and electrons flow out of the negative terminal, through the circuit and into the positive terminal of the source. However, the concept of Conventional Current is still applied to almost all the circuit schematics today.

Voltage is electrical pressure or force. Voltage is sometimes referred to as potential. Voltage drop is the difference in voltage between the two ends of a conductor through which current is flowing.

The work performed by an electrical current is called power. The unit of power is the watt.

An electrical current can flow in either of two directions through a conductor. If it flows in only one direction whether steadily or in pulses, it is called direct current (DC). In order to be able to work with DC we need to convert the alternating current (AC) from the outlets into a direct current, which we use to power the circuits.

Since direct current only flows in one direction, we have to be able to easily determine the positive and negative side of the power supply. Remember that we assume the conventional current flow from positive to negative when we work with circuits! By convention, positive is always marked with red and negative is always marked with black or blue. A multimeter is a useful tool that helps us finding the positive and negative side of the power supply. On the multimeter's rotary selection knob we see different sections for measuring voltage (volt-meter), current (am-meter) and resistance (ohm-meter), hence the name: multimeter.

Wires and cables are used to carry an electrical current. Most wire is protected by an insulating covering of plastic or rubber. A wire can be either solid or stranded. Cables have one or more conductors and more insulation than ordinary wire.

A diode is an electronic device that allows current to flow through it in one direction only. It is a one-way turnstile for electrons. There are many different classes of diodes for many different purposes: small signal diodes, rectifier (power) diodes (e.g. in power supplies), switching diodes, zeners, Light Emitting Diodes (LED)

The electrical resistance of an electrical element is the opposition to the passage of an electric current through that element; the inverse quantity is electrical conductance, the ease at which an electric current passes. Electrical resistance shares some conceptual

parallels with the mechanical notion of friction. Objects such as wires that are designed to have low resistance so that they transfer current with the least loss of electrical energy are called conductors. Objects that are designed to have a specific resistance so that they can dissipate electrical energy or otherwise modify how a circuit behaves are called resistors. Conductors are made of high-conductivity materials such as metals, in particular copper and aluminium. Resistors, on the other hand, are made of a wide variety of materials depending on factors such as the desired resistance, amount of energy that it needs to dissipate, precision, and cost.

Capacitors are electronic devices that store electrons. The simplest capacitor is two conductors separated by an insulating material called dielectric. The minus side of the capacitor is charged with electrons. These electrons in the charged capacitor will gradually leak through the dielectric until both conductor plates have an equal charge. The capacitor is then discharged. The ability to store electrons is called capacitance. Capacitance is specified in Farads. A 1-Farad capacitor connected to a 1 Volt supply will store 6,280,000,000,000,000,000 electrons. Once a capacitor has reached its maximum charge, it blocks DC voltage. This is used in electronic circuits to allow an alternating current (AC) signal to flow through a capacitor while it blocks DC. Sometimes capacitors are also used as smoothing or filtering device. Putting a capacitor across the plus and minus pole of a component filters out voltage spikes. Yet another use of capacitors makes use of their ability to store charge for highspeed use. This feature is applied, for example, in a photo flash.

I. Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

high charge, convention, difference in voltage, positive and negative side, rotary selection knob,low resistance, loss of electrical energy, plus and minus pole, the charged capacitor

Exercise 2. Answer the questions:

1.What is current?
2. What does an electric current flow through?
3. How is a wire protected?
4. How is ability to store electrons called?

Exercise 3. Match the left part with the right:

1. Wires and cables	a) with the mechanical notion of friction.
2. Electrical resistance shares some conceptual parallels	b) are used to carry an electrical current.
3. Once a capacitor has reached its maximum charge	c) we have to be able to easily determine the positive and negative side of the power supply.
4. Since direct current only flows in one direction	d) it blocks DC voltage.

Exercise 4. Open brackets choosing the right words

This is used in electronic (circuits/devices) to allow an alternating current (AC) signal to (flow/fly) through a capacitor while it blocks DC. Sometimes (capacitors/diodes) are also used as smoothing or (filtering/resisting) device. Putting a capacitor across the plus and minus (pole/side) of a component filters out voltage spikes.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1. Describe **current; voltage; conductor; multimeter; capacitor** using the suggested words and expressions as in example:

current quantity of electrons, ampere, flow, charge, potential **Example:** Current is the quantity of electrons passing a given point. The unit of current is the ampere. One ampere is 6,280,000,000,000,000,000 electrons passing a point in one second. Electrical current flows from a region of high charge or potential to a region of low potential.
voltage electrical pressure, potential
conductor objects, are designed, transfer current, least loss, are called
multimeter a useful tool, the positive and negative side, the power supply
capacitor electronic devices, store, two conductors, an insulating material, side is charged

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?
Answer:. The unit of power is the watt.
2) Question: _____ ?
Answer: A diode is an electronic device that allows current to flow through it in one direction only.
3) Question: _____ ?
Answer: The concept of Conventional Current is still applied to almost all the circuit schematics today.
Question: _____ ?

4) Answer: Objects that are designed to have a specific resistance so that they can dissipate electrical energy or otherwise modify how a circuit behaves are called resistors.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **of; as; to store; out; across; of**

Sometimes capacitors are also used ____smoothing or filtering device. Putting a capacitor _____ the plus and minus pole ___ a component filters ___ voltage spikes. Yet another use _____ capacitors makes use of their ability _____ charge for highspeed use.

Exercise 2. Fill in the table with words and expressions from the text:

	Colours	Chemical Materials	Different Purposes of Diodes
Example: By conversion positive is	always marked with red and negative is always marked with black or blue		
Conductors are made of high-conductivity materials			
There are many different classes of diodes for many			
Most wire is protected by an insulating covering			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Electric current. Types of currents»

«The Main Notions of Electricity»

«The main Electrical Elements»

T e x t 4

SYNTHESIS OF ELECTROMECHANICAL SYSTEM

THE READING MODULE

Read the text:

Developing new approaches to aiding computational synthesis of modern electromechanical systems is a major need. Current techniques use product representations that reason with single abstractions such as either geometry or physical dynamics. Further, these techniques are utilized in the context of static design processes. This article proposes the development of computational frameworks wherein both the process of design along with the product being designed are reasoned with in an integrated manner. Developing such a framework would require advances in product models that integrate geometric and behavioral abstractions. Further, development of new process models would require integration of planning and machine learning techniques that reason with these new product representations. An integrated framework would aid in the development of better cost-effective synthesis tools and allow for assimilating and reusing many kinds of design knowledge.

Design of modern electromechanical systems involves the configuration of a wide variety of building block components into an interconnected topology. For a given set of design requirements, many topologies are feasible as solutions. Concomitantly, the design process of generating these feasible topologies is also varied. The process involves cognitive reasoning steps such as idea generation, refinement, search, modeling, testing to name a few. The final result of the overall design activity, the final assembly, is shaped by the complex interplay between these cognitive reasoning steps and the underlying models of the building block components. Current approaches to facilitating computational synthesis are primarily focused on improving the underlying modeling abstractions of the building blocks. Our current understanding of the interplay between the design process and the evolution of the design artifact is rather minimal. Our current knowledge regarding interaction between design reasoning tasks and the underlying model are highly limited and very specific to the example domain/task under consideration.

The building block components that form the basis of modern electromechanical systems are differentiated along multiple abstractions:

Physical instantiation: The component is either hardware (usually the basic components that provide the functionality) or software (usually the controlling logic that integrates the subcomponents).

Model-type: The hardware can be analog or digital components, lumped parameter or distributed parameter models, deterministic models or models with various levels of uncertainty considerations in input-output behavior. These model types usually have a

linear or non-linear model formulation characterizing the generic behavior of the component.

Function: The functionality of a component is primarily due to its power or signal processing capability, or its material construction or due to its spatial geometry or some combination of all of the above. Modeling functions is a major research area and a variety of functional classifications has been proposed in the literature.

System-type: The assemblies constructed from these basic components can provide their functionality based on the energy, material and information flows while interacting with the environment. Basic systemic models such as open or closed with conservative or non-conservative flows (of energy, material, information) across the system boundaries. Modeling the interaction of the assembly with the environment is a complex issue.

I. Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

current technique; assimilating; interconnected topology; building block components; modeling abstraction; example domain/task; analog or digital components; signal processing capability

Exercise 2. Answer the questions:

1. What does the design of modern electromechanical systems involve?
2. What are current approaches primarily focused on?
3. What are the building blocks components differentiated along?
4. What is physical instantiation?

Exercise 3. Match the left part with the right:

1. The final result of the overall design activity, the final assembly is shaped	a) of better cost-effective synthesis tools and allow for assimilating and reusing many kinds of design knowledge
2. An integrated framework would aid in the development	b) is a complex issue
3. The process involves cognitive reasoning steps such as	c) by the complex interplay between these cognitive reasoning steps and the underlying models of the building block components.
4. Modeling the interaction of the assembly with the environment is	d) generation, refinement, search, modeling, testing to name a few

Exercise 4. Open brackets choosing the right words

Our current understanding of the (interplay/interact) between the design process and the (evolution/revolution) of the design artifact is rather (minimal/maximal). Our

current knowledge regarding interaction between (design/speed) reasoning tasks and the underlying model are highly (limited/broad) and very specific to the example domain/task under consideration.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1. Describe **technique; interconnected topology; building block; model-type; system-type** using the suggested words and expressions as in example:

technique product representations, single abstractions, dynamics, are utilized, static design processes **Example:** Current techniques use product representations that reason with single abstractions such as either geometry or physical dynamics. Further, these techniques are utilized in the context of static design processes.
interconnected topology design requirements, feasible as solutions, the design process, is varied
building block overall design activity, the final assembly, cognitive reasoning steps, current approaches are primarily focused, the underlying modeling abstractions
model-type the hardware, lumped parameter, deterministic models, various levels, in input-output behavior
system-type the assemblies, their functionality, the environment, open or closed, the system boundaries, the interaction, with the environment

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: Developing new approaches to aiding computational synthesis of modern electromechanical systems is a major need.

2) Question: _____ ?

Answer: These techniques are utilized in the context of static design processes.

3) Question: _____ ?

Answer: Modeling functions is a major research area and a variety of functional classifications have been proposed in the literature.

4) Question: _____ ?

Answer: Current approaches to facilitating computational synthesis are primarily focused on improving the underlying modeling abstractions of the building blocks.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **by, of, between, of, and**

The final result ____ the overall design activity, the final assembly, is shaped ___ the complex interplay ___these cognitive reasoning steps ___ the underlying models ___the building block components.

Exercise 2. Fill in the table with words and expressions from the text:

	Abstractions	Behavior of the Components	Capability
Example: Developing such a framework would require advances in product models	that integrate geometric and behavioral abstractions		
These model types usually have a linear or non-linear model formulation			
The functionality of a component is primarily due to its			
Current approaches to facilitating computational synthesis are primarily focused on improving the underlying			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Development of computational frameworks in modern electromechanical systems».

«Building block component differentiation».

«System-type abstraction»

T e x t 5

MODELING OF ELECTROMECHANICAL SYSTEM

THE READING MODULE

Read the text:

The fundamental equations of motion for physical continua are partial differential equations (PDEs), which describe dynamic behavior in both time and space. For example, the motions of strings, elastic beams and plates, fluid flow around and through bodies, as well as magnetic and electric fields require both spatial and temporal information. These equations include those of elasticity, electrodynamics, the Navier–Stokes equations of fluid mechanics, and the Maxwell–Faraday equations of electromagnetics.

Many practical electromechanical devices can be modeled by lumped physical elements such as mass or inductance. The equations of motion are then integral forms of the basic PDEs (partial differential equations) and result in coupled ordinary differential equations (ODEs). Where physical problems have spatial distributions, one can often separate the problem into spatial and temporal parts called separation of variables. The spatial description is represented by a finite number of spatial or eigenmodes each of which has its modal amplitude. This method again results in a set of ODEs.

Some machines are constructed in a closed kinematic chain so that the motion of one link determines the motion of the rest of the rigid bodies in the chain, as in the four-bar linkage. In these problems the designer does not have to solve differential equations of motion. Newton's laws are used to determine forces in the machine, but the motions are kinematic, determined through the geo-metric constraints. In open link problems, such as robotic devices the motion of one link does not determine the dynamics of the rest. The motions of these devices are inherently dynamic. The engineer must use both the kinematic constraints as well as the Newton–Euler differential equation of motion or equivalent forms such as Lagrange's equation.

Piezoelastic materials exhibit a coupling between strain and electric polarization or voltage. Thus, these materials can be used for sensors or actuators. They have been used for active vibration suppression in elastic structures. They have also been explored for active optics space applications. Many natural materials exhibit piezoelasticity such as quartz as well as manufactured materials such as barium titanate, lead zircon titanate (PZT), and polyvinylidene fluoride (PVDF). Unlike forces on charges and currents , the electric effect takes place through a change in shape of the material. The modeling of these devices can be done by modifying the equations for elastic structures.The elastic beam is of rectangular cross section as in the piezo element. The piezo element can be cemented on one or both sides of the beam either partially or totally covering the surface of the non-piezo substructure.

If the piezo layers are polled in the opposite directions, an applied voltage will produce a strain extention in one layer and a strain contraction in the other layer, which has the effect of an applied moment on the beam. The electrodes applied to the top and bottom layers of the piezo layers can also be shaped so that there can be a gradient in the average voltage across the beam width.

I. Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

equation of motion; spatial and temporal information; lumped physical element; distributions; variable; finite number; closed kinematic chain; coupling; piezoelasticity; shape; piezo layer

Exercise 2. Answer the questions:

1. What are the fundamental equations of motion for physical continua?
2. What do differential equations describe?
3. By what is the spatial description represented?
4. How are some machines constructed?

Exercise 3. Match the left part with the right:

1. The spatial description is represented	a) strain and electric polarization or voltage.
2. In open link problems such as robotic devices the motion of one link does not determine the dynamics of the rest.	b) by a finite number of spatial or eigenmodes each of which has its modal amplitude.
3. The motions of these devices	c) robotic devices the motion of one link does not determine the dynamics of the rest.
4. Piezoelastic materials exhibit a coupling between	d) are inherently dynamic.

Exercise 4. Open brackets choosing the right words

The (elastic/radio) beam is of rectangular cross section as is the (piezo/dielectric) element. The piezo (element/device) can be cemented on one or both sides of the beam either partially or totally covering the (surface/edge) of the non-piezo substructure.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1. Describe **spatial description;closed kinematic chain;Newton's laws;elastic beam;**
piezo layer using the suggested words and expressions as in example:

spatial description is represented; spatial or eigenmodes; modal amplitude; results a set of ODEs

Example: The spatial description is represented by a finite number of spatial or eigenmodes each of which has its modal amplitude. This method again results in a set of ODEs.
closed kinematic chain are constructed; the motion of one link; the rest of the rigid bodies; in the four-bar linkage

Newton's laws are used ;forces; kinematic; through the geo-metric constraints
elastic beam rectangular cross section; the piezo element; on one or both sides; partially or totally; the non-piezo substructure.
piezo layer in the opposite directions; a strain extention; a strain contraction; the effect; on the beam.

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: These equations include those of elasticity, electrodynamics, the Navier–Stokes equations of fluid mechanics, and the Maxwell–Faraday equations of electromagnetics.

2) Question: _____ ?

Answer: They have also been explored for active optics space applications.

3) Question: _____ ?

Answer: Where physical problems have spatial distributions, one can often separate the problem into spatial and temporal parts called separation of variables.

4) Question: _____ ?

Answer: The piezo element can be cemented on one or both sides of the beam.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **space, active, elastic, sensors**

Thus, these materials can be used for _____ or actuators. They have been used for _____ vibration suppression in _____ structures. They have also been explored for active optics _____applications.

Exercise 2. Fill in the table with words and expressions from the text:

	Types of Equations	Names of the Scientists	Natural Materials
Example: The fundamental equations of motion for physical continua are partial differential equations (PDEs),	partial differential equations (PDEs)		
The equations of motion are then integral forms of			

The engineer must use both the kinematic constraints as well as			
Many natural materials exhibit piezoelasticity such as quartz as well as manufactured materials such as			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«The Fundamental Equations of Motion»

«Newton's laws Application in Electromechanics»

«Piezoelastic materials»

T e x t 6

OPTIMIZATION METHODS IN ELECTROMECHANICAL SYSTEMS

THE READING MODULE

Read the text:

Most real-life design optimization problems require the simultaneous optimization of several possibly conflicting objective functions. The multi-objective problem is almost

always transferred into one or a sequence of single objective or scalar optimization problems (scalarization) whose solutions are pareto optimal for problem Those scalar problems are then solved by efficient and reliable algorithms for single objective nonlinear optimization. In the optimization modules used in our software environment, numerical methods for multi-objective optimization based on a priori and a posteriori preferences are available.

Due to its efficiency and robustness we will only look at so-called sequential quadratic programming (SQP) methods.

These have been established as the standard general purpose tool for solving smooth nonlinear optimization problems under the following assumptions:

- the problem is not too large
- the functions and gradients can be evaluated with sufficiently high precision
- the problem is smooth and well-scaled
- there is no further model structure that can be exploited.

Electromechanical transducers, working as sensors and actuators, play an increasing role in a large variety of applications, ranging from process technology, automotive industry, electro medicine, to consumer products. In order to speed up the design of these devices, the use of simulation tools which are based on numerical methods has become more and more attractive. Due to the presence of different electromechanical coupling effects, the simulation of such a device typically exhibits significant complexity in its own, especially when nonlinearities have to be taken into account. Furthermore, the development of an electromechanical transducer is usually also constrained by certain boundary conditions regarding, for example, functionality, shape, or both. Therewith, an optimization problem for a coupled field problem has to be considered in the design process of such an electromechanical device. The standard approach in solving this task consists in applying a black-box coupling of simulation and optimization software and is applied successfully in many different areas. However, especially in problems involving coupled physical systems, such as electromechanical transducers, the application of this approach may be limited by efficiency considerations. Problems with a solution time of only 1 hour for a single simulation may easily lead to calculation times of several weeks in case of a complex problem with several optimization parameters.

The computer based optimization of an electromechanical transducer requires efficient simulation algorithms coupled to automated optimization solutions.

Priori methods are methods where the preference must be specified before the solution process. One possibility is the so called preference or value function approach, where an accurate and explicit mathematical formulation of a scalar preference or value function which represents the preference globally must be given. The difficulty is that for most problems the engineer does not necessarily know beforehand what is possible to attain in the problem and how realistic her or his expectations are. Most deterministic mathematical schemes for the solution of multi-objective

optimization problems are based on solving one or a sequence of multiple single objective optimization problems. Several different categories of optimization algorithm can be distinguished.

I. Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

simultaneous optimization; reliable algorithms; gradient; high precision; electromechanical transducer; simulation; complexity; boundary condition; a black-box coupling; sequence

Exercise 2. Answer the questions:

1. How can you solve amulti-objective problem?
2. What assumptions are necessary for solving smooth nonlinear optimization problems?
3. What is the role of electromechanical transducers in a large variety of applications?
4. What does the computer based optimization of an electromechanical transducer require?

Exercise 3. Match the left part with the right:

1. In order to speed up the design of these devices	a. the application of this approach may be limited by efficiency considerations.
2. The difficulty is that for most problems the engineer does not necessarily know beforehand	b. the use of simulation tools which are based on numerical methods has become more and more attractive.
3. However, especially in problems involving coupled physical systems, such as electromechanical transducers	c. can be distinguished
4. Several different categories of optimization algorithm	d. what is possible to attain in the problem and how realistic her or his expectations are.

Exercise 4. Open brackets choosing the right words

Most deterministic (mathematical/algorithmic) schemes for the solution of (multi-objective/single objective) optimization problems are based on (solving/simulating) one or a sequence of multiple single objective optimization (problems/devices). Several different categories of optimization (algorithm/table) can be distinguished.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1. Describe **optimization problem; electromechanical transducer; electromechanical coupling; a coupled field problem; scalar preference** using the suggested words and expressions as in example:

optimization problem require; the simultaneous optimization; ; the multi-objective problem; a sequence; solutions; optimal **Example**: Most real-life design optimization problems require the simultaneous optimization of several possibly conflicting objective functions. The multi-objective problem is almost always transferred into one or a sequence of single objective or scalar optimization problems (scalarization) whose solutions are pareto optimal for problem.
electromechanical transducer sensors and actuators; variety of applications; ranging from; electro medicine; to consumer products
electromechanical coupling effects; such a device; significant complexity; nonlinearities; take into account
a coupled field problem an optimization problem; the design process; the standard approach; applying a black-box coupling; software; many different areas
scalar preference the so called preference; mathematical formulation; value function; globally

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: Those scalar problems are then solved by efficient and reliable algorithms.

2) Question: _____ ?

Answer: The computer based optimization of an electromechanical transducer requires efficient simulation algorithms coupled to automated optimization solutions.

3) Question: _____ ?

Answer: Priori methods are methods where the preference must be specified before the solution process.

4) Question: _____ ?

Answer: Problems with a solution time of only 1 hour for a single simulation may easily lead to calculation times of several weeks in case of a complex problem with several optimization parameters.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **in; on;for; by**

Those scalar problems are then solved ____ efficient and reliable algorithms ____ single objective nonlinear optimization. ____ the optimization modules used in our software environment, numerical methods for multi-objective optimization based ___ a priori and a posteriori preferences are available.

Exercise 2. Fill in the table with words and expressions from the text:

	Aproaches	Conditions	Programming Methods
Example: The development of an electromechanical transducer is usually also constrained by certain boundary conditions regarding, for example, functionality, shape,		regarding, for example, functionality, shape or both.	
The standard approach in solving this task consists			
Due to its efficiency and robustness we will only look at so-called			
In the optimization modules used in our software environment			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Optimization Problem Solving»

«Electromechanical Transducers»
«Preference or Value Function Approach»

T e x t 7

FUNDAMENTALS OF METROLOGY AND ELECTRICAL MEASUREMENTS

THE READING MODULE

Read the text:

Metrology is the science of measurement. Metrology includes all theoretical and practical aspects of measurement. Metrology is essential in scientific research, and scientific research forms the basis of the development of metrology itself. Science pushes forward the frontiers of the possible all the time and fundamental metrology follows the metrological aspects of these new discoveries. This means ever better metrological tools enabling researchers to continue their discoveries – and only those fields of metrology that do develop can continue to be a partner for industry and research. Metrology is the science that establishes the correctness of specific measurement situations.

Accurate measurements are central to virtually every scientific and engineering discipline, but all too often measurement science gets little attention in the undergraduate curriculum. Even those who received a thorough grounding in measurement fundamentals as undergraduates can be forgiven if they've forgotten some of the details. When considering a specific measurement instrument for an application, the specification or data sheet is the first place to look for information on its performance and how that will limit the results. However, data sheets are not always easy to interpret because they typically use specialized terminology, we'll speak below.

Measuring Voltage

The ideal voltmeter draws no current and has a very high input impedance. In the old days, we were happy if our voltmeters exhibited 10,000 ohms/volt. Modern DVMs (Digital Voltmeter) often have input impedances of over 100 Megohms (I00,000,000 ohms). Voltmeters read across the circuit or load under test. This means that typical readings are taken with the circuit in operation. In fact, it would be meaningless to measure the voltage across a load that was not in operation because the result should be zero volts. There is, however, validity in measuring the open circuit supply voltage as well as the supply potential when under load. This measurement will tell us just how much the load is effecting the supply.

Measuring Current

The ideal current meter (ammeter) has zero input impedance. In fact, it should represent a short circuit. An ammeter is always placed in series with the circuit to be

measured. This is why an ammeter with a very low input impedance is desirable - so that it will have a minimal effect on the circuit under examination. Ammeters work by measuring the voltage dropped across what is known as a shunt resistor. Clip on ammeters work on a slightly different principle, but, they can be accurate to within approximately 2% and are easy to use. To measure the current flowing in a particular closed circuit, the circuit must first be broken and the ammeter must be connected in series. When the circuit is reactivated, current will flow through the ammeter's shunt resistor causing a voltage drop across the resistor. This voltage drop is then displayed on a voltmeter that is calibrated in amps.

Measuring Power

To measure power, both the voltage across the circuit and the current flowing through the circuit must be known. This does not usually present us with too much of a problem for steady state DC (direct current), but with the varying phase relationship between the current and the voltage in AC (alternating current) circuits, accurately measuring the power can be a little tricky. Typically power meters are used with frequencies under 1000 Hz. With two meters, the measurement of power in DC circuits can be straightforward. For instance, if the input resistance of a turn-on sensing circuit is too high, then just about any stray voltage can activate the circuitry. On the other hand, if the input resistance is too low, excessive current will flow in the circuit and possibly overload the source. Almost always the source of turn-on current is a semiconductor device with limited output capability. In some extreme cases the amount of current available at the "electric antenna turn-on output" was found to be less than 50 mA. Now remember, semi-conductor devices are usually associated with a voltage drop of their own. This means that there will normally be less than the input voltage available at the output of a transistor-switched device. Don't forget that as the voltage goes down, the current must increase to perform a given amount of work.

I. Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

metrology; discoveries; curriculum; data sheet; in series; shunt resistor; closed circuit; turn-on sensing circuit; overload; semiconductor device; turn-on output; transistor-switched device

Exercise 2. Answer the questions:

1. What is the function of a voltmeters?
2. Where is an ammeter placed?
3. What is a shunt resistor?
4. Where is the voltage drop displayed?

Exercise 3. Match the left part with the right:

1. Metrology is the science that establishes the correctness of	a) but, they can be accurate to within approximately 2% and are easy to use.

2. In fact, it would be meaningless to measure the voltage across a load	b) the metrological aspects of these new discoveries.
3. Science pushes forward the frontiers of the possible all the time and fundamental metrology follows	c) specific measurement situations.
4. Clip on ammeters work on a slightly different principle,	d) that was not in operation because the result should be zero volts.

Exercise 4. Open brackets choosing the right words

When the (circuit/battery) is reactivated, current will flow through the (ammeter's/voltmeter's) shunt resistor causing a voltage (drop/rise) across the resistor. This voltage drop is then (displayed/measured) on a voltmeter that is calibrated in (amps/watts).

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1**.** Describe **scientific research; data sheet; open circuit supply voltage; shunt resistor; steady state DC** using the suggested words and expressions as in example:

scientific research metrology; forms the basis; the development **Example:** Metrology is essential in scientific research, and scientific research forms the basis of the development of metrology itself.
data sheet specific; for an application; look for information; limit the results.
open circuit supply voltage validity; as well as; under load; this measurement; is effecting the supply
shunt resistor ammetersthe voltage dropped; known as
steady state DC present; too much; problem

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: Data sheets are not always easy to interpret because they typically use specialized terminology.

2) Question: _____ ?

Answer: Metrology includes all theoretical and practical aspects of measurement.

3) Question: _____ ?
Answer: Voltmeters read across the circuit or load under test.
4) Question: _____ ?
Answer: Typically power meters are used with frequencies under 1000 Hz.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **minimal; placed; resistor; low**

An ammeter is always _____ in series with the circuit to be measured. This is why an ammeter with a very low input impedance is desirable - so that it will have a _____ effect on the circuit under examination. Ammeters work by measuring the voltage dropped across what is known as a shunt resistor.

Exercise 2. Fill in the table with words and expressions from the text:

	Measuring Devices	Science	Electrical Units
Example: Metrology is		the science of measurement	
In the old days, we were happy			
To measure the current flowing in a particular closed circuit, the circuit must first be broken			
Modern DVMs (Digital Voltmeter) often have input impedances of over			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Subject of Metrology»

«Measuring Devices»

«Principles of Operation of Ammeter, Voltmeter, Wattmeter»

T e x t 8
ELECTRIC VEHICLES

THE READING MODULE

Read the text:

There are two kinds of electric vehicles currently in use: battery-operated electrics and hybrid electric vehicles, or HEVs. Battery-operated electrics run on electricity stored in batteries, electricity that ultimately comes from generating plants that also provide our homes with electrical power. With HEVs, most electricity is produced by small onboard generating plants driven by internal combustion engines. HEVs can be designed to run on gasoline, diesel, or alternative fuels. Battery-operated electric vehicles are sometimes referred to as "zero emission vehicles" because they do not directly pollute through tailpipe emissions, fuel evaporation, fuel refining, or fuel transport to service stations.

A certain amount of pollution, however, is associated with the use of these vehicles. Pollution levels from battery-operated electric vehicles remain extremely low even when these emissions are taken into account.

The generators and motors used in electric vehicles are much more efficient than the power trains of internal combustion engines. The difference is such as to make it more efficient to burn an amount of fuel in a power plant to generate electricity for an electric vehicle than to burn it directly in a vehicle's internal combustion engine. Adding to the efficiency of electric vehicles is the technique of regenerative braking. This involves slowing and stopping a vehicle by absorbing its energy and converting it to electricity that may be returned to the vehicle's onboard battery. In a conventional vehicle, this energy is simply wasted as heat.

Electric vehicles turn out to be more than 90% cleaner than the cleanest conventional gasoline-powered vehicle when the electricity running them comes from clean energy sources such as natural gas, nuclear power, hydropower, or renewable fuels. Electric vehicles remain cleaner than comparable gasoline-powered vehicles even when the electricity they use derives from polluting fuels like coal. The reasons are their high-efficiency electric power trains and the fact that modern coal-burning generating plants produce electricity more efficiently and with fewer emissions than they did in the past.

Much development work has gone into HEVs, which provide the efficiency advantages of electric drivetrains without burdening vehicles with the large, heavy battery packs found in battery-operated electrics. HEVs basically consist of an internal combustion engine, a generator to turn the energy developed by the engine into electricity, and an electric motor to propel the vehicle. Hybrids also include a relatively small battery pack to store energy recovered through regenerative braking and to provide extra power beyond what the generator can produce on its own when the vehicle must accelerate quickly.

What battery-operated vehicles give up in range, they return in refueling convenience. Drivers can refuel a battery-operated vehicle by simply plugging it into a

special recharging outlet at home. The recharging time depends on the voltage of the recharging station, the ambient air temperature, the size and type of the battery pack, and the remaining electrical energy in storage. Typically, the process takes several hours, but batteries are being developed that can be recharged more quickly. The cost of fully recharging a battery pack varies with the rates charged by local utility.

I. Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

hybrid; onboard; internal combustion engine; gasolinerefining; pollution; burn; regenerative braking; conventional; renewable fuel; derives; propel; accelerate; convenience; plugging into

Exercise 2. Answer the questions:

1. What is the main difference between battery-operated electrics and hybrid electric vehicles?
2. What is the technique of regenerative braking?
3. Why are electric vehicles cleaner than the cleaneast gasoline-powered vehicles?
4. What do HEVs basically consist of?

Exercise 3. Match the left part with the right:

1. HEVs basically consist of an internal combustion engine, a generator to turn the energy developed by the engine into electricity, and an electric motor to propel the vehicle.	a) however, is associated with the use of these vehicles.
2. A certain amount of pollution, however, is associated with the use of these vehicles	b) that modern coal-burning generating plants produce electricity more efficiently and with fewer emissions than they did in the past.
3. The recharging time depends on	c) an internal combustion engine, a generator to turn the energy developed by the engine into electricity, and an electric motor to propel the vehicle.
4. The reasons are their high-efficiency electric power trains and the fact	d) the voltage of the recharging station, the ambient air temperature, the size and type of the battery pack, and the remaining electrical energy in storage.

Exercise 4. Open brackets choosing the right words

The generators and motors (used/stored) in electric vehicles are much more (efficient/ unefficient) than the power trains of internal combustion engines. The (difference/similarity) is such as to make it more efficient to burn an amount of

(fuel/solution) in a power plant to generate electricity for an (electric/mechanical) vehicle than to burn it directly in a vehicle's internal combustion engine.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1**.** Describe **battery-operated electrics; hybrid electric vehicle (HEV); recharging outlet; internal combustion engine; regenerative braking** using the suggested words and expressions as in example:

battery-operated electrics run; stored in batteries; comes from; plants; our homes **Example:** Battery-operated electrics run on electricity stored in batteries, electricity that ultimately comes from generating plants that also provide our homes with electrical power.
hybrid electric vehicle (HEV) development work; provide; electric drivetrains; burdening vehicles; the large, heavy battery packs
recharging outlet battery-operated vehicles; return; convenience; refuel; by plugging into; at home
internal combustion engine the generators and motors; much more efficient; the power trains
regenerative braking the efficiency; technique; slowing and stopping; absorbing and converting; may be returned

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: There are two kinds of electric vehicles currently in use: battery-operated electrics and hybrid electric vehicles, or HEVs

2) Question: _____ ?

Answer: The cost of fully recharging a battery pack varies with the rates charged by local utility.

3) Question: _____ ?

Answer: Electric vehicles remain cleaner than comparable gasoline-powered vehicles even when the electricity they use derives from polluting fuels like coal.

4) Question: _____ ?

Answer: Regenerative braking involves slowing and stopping a vehicle by absorbing its energy and converting it to electricity.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **what; to; on; through;when; to**

Hybrids also include a relatively small battery pack _____ store energy recovered _____ regenerative braking and to provide extra power beyond _____ the generator can produce _____ its own _____ the vehicle must accelerate quickly.

Exercise 2. Fill in the table with words and expressions from the text:

	Chemical Element	Level of Pollution	Period of Time
Example: Electric vehicles turn out to be more than 90% cleaner		than the cleanest conventional gasoline-powered vehicle	
Electric vehicles remain cleaner than comparable gasoline-powered vehicles			
Typically, the process of recharging			
The electricity running them comes from clean energy sources such as			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Kinds of Electric Vehicles»

«Electric Vehicles Advantages in Cleanliness»

«Electric Vehicles Advantages in Refueling»

T e x t 9

MOTOR CONTROL SYSTEM

THE READING MODULE

Read the text:

There are four major motor control topics or categories to consider. Each of these has several subcategories and sometimes the subcategories overlap to some extent. Certain pieces of motor control equipment can accomplish multiple functions from each of the topics or categories.

Motor Controller

A motor controller is the actual device that energizes and de-energizes the circuit to the motor so that it can start and stop.

Motor controllers may include some or all of the following motor control functions: starting, stopping, over-current protection, overload protection, reversing, speed changing, jogging, plugging, sequence control, and pilot light indication.Controllers range from simple to complex and can provide control for one motor, groups of motors, or auxiliary equipment such as brakes, clutches, solenoids, heaters, or other signals.A manual motor starter is a package consisting of a horsepower rated switch with one set of contacts for each phase and corresponding thermal overload devices to provide motor overload protection.The main advantage of a manual motor starter is lower cost than a magnetic motor starter with an equivalent motor protection but less motor control capability.Manual motor starters are often used for smaller motors - typically fractional horsepower motors .

Since the switch contacts remain closed if power is removed from the circuit without operating the switch, the motor restarts when power is reapplied which can be a safety concern.They do not allow the use of remote control or auxiliary control equipment like a magnetic starter does.

Motor protection safeguards the motor, the supply system and personnel from various operating conditions of the driven load, the supply system or the motor itself. Motor protection categories include: overcurrent protection, overload protection, other types of protection. The National Electrical Code requires that motors and their conductors must be protected from both overcurrent and overload conditions.

Overcurrent Protection

Overcurrent protection interrupts the electrical circuit in case of excessive current safeguarding against short circuits or ground faults.Overcurrent protection is required to protect personnel, the motor branch circuit conductors, control equipment, and motor from these high currents.Overcurrent protection is usually provided in the form of fuses or circuit breakers. These devices operate when a short circuit, ground fault or an extremely heavy overload occurs.

Most overcurrent sources produce extremely large currents very quickly.Overload protection is installed in the motor circuit and/or motor to protect the motor from damage from mechanical overload conditions when it is operating/running.

The effect of an overload is an excessive rise in temperature in the motor windings due to current higher than full load current.

Properly sized overload protection disconnects the motor from the power supply when the heat generated in the motor circuit or windings approaches a damaging level. The larger the overload, the quicker the temperature approximation towards the point damaging the insulation and lubrication of the motor.

I. Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

overlap; over-current protection; jogging; plugging; auxiliary equipment; manual motor starter; horsepower motor; safety; remote control; supply system; motor winding; insulation

Exercise 2. Answer the questions:

1. What is a motor controller?
2. What can controller provide?
3. How can you characterize a manual controller starter?
4. When do curcuit breakers operate?

Exercise 3. Match the left part with the right:

1. The main advantage of a manual motor starter is lower cost	a) when a short circuit, ground fault or an extremely heavy overload occurs.
2. These devices operate	b) than a magnetic motor starter with an equivalent motor protection but less motor control capability.
3. The effect of an overload is an excessive rise	c) personnel from various operating conditions of the driven load, the supply system or the motor itself
4. Motor protection safeguards the motor, the supply system and	d) in temperature in the motor windings due to current higher than full load current

Exercise 4. Open brackets choosing the right words

Since the switch contacts remain (opened\ closed) if power is removed (from\of) the circuit (without\ with) operating the switch, the motor (does\restarts) when power is reapplied which can be a safety concern.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1**.** Describe **motor controller; magnetic starter; short circuit; circuit breaker;**
motor winding using the suggested words and expressions as in example:

motor controller actual device; energizes; circuit; start and stop **Example:** A motor controller is the actual device that energizes and de-energizes the circuit to the motor so that it can start and stop.
magnetic starter allow; remote control; equipment; like
short circuit overcurrent protection; electrical circuit; excessive; ground fault
circuit breaker overcurrent protection; the form of fuses; devices; heavy overload
motor winding effect; an excessive rise; due to; full load current

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: There are four major motor control topics or categories to consider.

2) Question: _____ ?

Answer: Most overcurrent sources produce extremely large currents very quickly.

3) Question: _____ ?

Answer: A manual motor starter is a package consisting of a horsepower rated switch.

4) Question: _____ ?

Answer: The larger the overload, the quicker the temperature approximation towards the point damaging the insulation and lubrication of the motor.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentence with the suggested words: **types**; **protection; driven load; categories; personnel;**

Motor _____ safeguards the motor, the supply system and _____ from various operating conditions of the _____, the supply system or the motor itself. Motor protection _____ include: overcurrent protection, overload protection, other _____ of protection.

Exercise 2. Fill in the table with words and expressions from the text:

	Equipment	Conditions	Functions
Example: Motor controllers may include some or all of the following motor control functions:			starting, stopping, over-current protection, overload protection, reversing, speed changing, jogging, plugging, sequence control, and pilot light indication.
A manual motor starter is a package consisting of			
The National Electrical Code requires that motors and their conductors must be protected			
Controllers range from simple to complex and can provide control for			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«What is Motor Controller»
«Manual Motor Starter»
«Types of Protection»

T e x t 10

THEORY OF AN ACTUATOR

THE READING MODULE

Read the text:

An actuator is something that converts energy into motion. It also can be used to apply a force. An actuator typically is a mechanical device that takes energy, usually energy that is created by air, electricity or liquid, and converts it into some kind of motion. That motion can be in virtually any form, such as blocking, clamping, ejecting or many other types of motion. Actuators typically are used in manufacturing or industrial applications and might be used in devices such as motors, pumps, switches and valves.

Perhaps the most common type of actuator is powered by air — the pneumatic cylinder, also known as the air cylinder. Air cylinders are air-tight cylinders, typically made from metal, that use the stored energy of compressed air to move a piston when the air is released or uncompressed. They are most commonly used in manufacturing and assembly processes. Grippers, which are used in robotics, use actuators that are driven by compressed air to work much like human fingers.

An air actuator, also called a pneumatic actuator, is a device made to produce motion through air pressure. Depending on how the actuator is set up, an air actuator is able to make either rotary or linear motion, and some special actuators can produce both. One of the most important parts of this type of actuator is the piston, which is directly responsible for how much power the device can output and may decrease the amount of incoming air pressure required. While this system is one of the strongest, the power will sharply decrease if there is anything blocking the air input.

Every actuator is made to push other parts via motion, and a power source is needed to make this motion. With an air actuator, air pressure is the predominant energy. This tends to be stronger than other power sources and often leads to fewer electrical parts, but this actuator needs many mechanical parts. There needs to be parts, such as an air compressor and piston, to regulate and produce the air. Air also is cleaner than other methods, such as hydraulic, because liquids are not needed for the actuator to work.

Like most actuators, an air actuator is able to create either rotary or linear movement. Rotary air actuators are able to create circular and angular movements, while linear air actuators move backward and forward. Some air actuators are able to combine both movement types, but most are one or the other.

An actuator also can be powered by electricity or hydraulics. Much like there are air cylinders, there also are electric cylinders and hydraulic cylinders in which the cylinder converts electricity or hydraulics into motion. Hydraulic cylinders are often used in certain types of vehicles.

Electric actuators are more cost-effective than their hydraulic and pneumatic counterparts. Electric actuators benefit from cleaner, simpler, and more energy-efficient power transmission. Electric actuator integration is easier with programmable controls,

and maintenance is minimized with no parts replacement or lubrication needed except in extreme conditions..

Many actuators have more than one type of power source. Solenoid valves, for example, can be powered by both air and electricity. Alternatively, the solenoid can be powered by both hydraulics and electricity.

Actuators can create a linear motion, rotary motion or oscillatory motion. That is, they can create motion in one direction, in a circular motion or in opposite directions at regular intervals. Hydraulic and air cylinders can be classified as single-acting cylinders, meaning that the energy source causes movement in one direction and a spring is used for the other direction. Alternatively, these cylinders can be double-acting cylinders, meaning that the energy is used in two directions.

I. Reading Exercises:

Exercise 1. Read and memorize using a dictionary:

convert; pneumatic cylinder; compressed air; assembly process; piston; decrease; air input; liquid; linear; circular; pneumatic counterparts; maintenance; solenoid valve; direction; spring

Exercise 2. Answer the questions:

1. What is an actuator?
2. Where are actuators used?
3. What can an actuator be powered by?
4. How can hydraulic and air cylinders be classified?

Exercise 3. Match the left part with the right:

1. An air actuator, also called a pneumatic actuator	a) able to create either rotary or linear movement.
2. Like most actuators, an air actuator is	b) is a device made to produce motion through air pressure.
3. With an air actuator	c) meaning that the energy is used in two directions.
4. Alternatively, these cylinders can be double-acting cylinders	d) air pressure is the predominant energy.

Exercise 4. Open brackets choosing the right words

An actuator (typically/sometimes) is a mechanical device that takes (energy/motion), usually energy that is created by air, (electricity/mechanics) or liquid, and converts it into some kind of (motion/interval). That motion can be in virtually (any/exact) form, such as blocking, clamping, ejecting or (many/several) other types of motion.

THE SPEAKING MODULE

II. Speaking Exercises:

Exercise 1**.** Describe **motion; air cylinder; piston; air pressure; electric actuator**

using the suggested words and expressions as in example:

motion any form; blocking; clamping; ejecting; other types **Example:**That motion can be in virtually any form, such as blocking, clamping, ejecting or many other types of motion.
air cylinder air-tight cylinders; metal; compressed air; a piston; is released; most commonly; assembly processes
piston one of the most important parts; responsible for; device; decrease; incoming air pressure
air pressure air actuator; the predominant energy; other power sources; fewer electrical parts; needs
electric actuator benefit from; power transmission; integration; programmable controls; no parts replacement; extreme conditions

Exercise 2. Ask questions to the given answers:

1) Question: _____ ?

Answer: An actuator is something that converts energy into motion.

2) Question: _____ ?

Answer: Perhaps the most common type of actuator is powered by air — the pneumatic cylinder, also known as the air cylinder.

3) Question: _____ ?

Answer: Actuators can create a linear motion, rotary motion or oscillatory motion.

4) Question: _____ ?

Answer: Hydraulic cylinders are often used in certain types of vehicles.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentence with the suggested words: source; **air; cylinders; directions; spring**

Hydraulic and _____cylinders can be classified as single-acting _____, meaning that the energy _____ causes movement in one direction and a_____ is used for the other direction. Alternatively, these cylinders can be double-acting cylinders, meaning that the energy is used in two _____.

Exercise 2. Fill in the table with words and expressions from the text:

	Mechanical Parts	Types of Movements	Material
Example: Rotary air actuators are able to create		circular and angular movements, while linear air actuators move backward and forward.	
There needs to be parts, such as			
Depending on how the actuator is set up, an air actuator is able to make			
Air cylinders are air-tight cylinders, typically made			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Types of Actuators»
«Mechanical Parts in Actuators»
«Sources of Energy for Actuators»

UNIT 3

RADIO-ELECTRONIC DEVICES

T e x t 1

TELECOMMUNICATIONS. BASIC ELEMENTS

THE READING MODULE

Read the text:

A telecommunication system consists of three basic elements: a transmitter that takes information and converts it to a signal; a transmission medium that carries the signal; and a receiver that receives the signal and converts it back into usable information.

For example, in a radio broadcast the broadcast tower is the transmitter, free space is the transmission medium and the radio is the receiver. Often telecommunication systems are two-way with a single device acting as both a transmitter and receiver or *transceiver*. For example, a mobile phone is a transceiver.

Telecommunication over a phone line is called point-to-point communication because it is between one transmitter and one receiver. Telecommunication through radio broadcasts is called broadcast communication because it is between one powerful transmitter and numerous receivers.

Signals can be either analogue or digital. In an analogue signal, the signal is varied continuously with respect to the information. In a digital signal, the information is encoded as a set of discrete values (for example ones and zeros). During transmission the information contained in analogue signals will be degraded by noise. Conversely, unless the noise exceeds a certain threshold, the information contained in digital signals will remain intact. This noise resistance represents a key advantage of digital signals over analogue signals.

A collection of transmitters, receivers or transceivers that communicate with each other is known as a network. Digital networks may consist of one or more routers that route information to the correct user. An analogue network may consist of one or more switches that establish a connection between two or more users. For both types of network, repeaters may be necessary to amplify or recreate the signal when it is being transmitted over long distances. This is to combat attenuation that can render the signal indistinguishable from noise.

A channel is a division in a transmission medium so that it can be used to send multiple streams of information. For example, a radio station may broadcast at 96.1 MHz while another radio station may broadcast at 94.5 MHz. In this case, the medium has been divided by frequency and each channel has received a separate frequency to broadcast on. Alternatively, one could allocate each channel a recurring segment of time

over which to broadcast — this is known as time-division multiplexing and is sometimes used in digital communication.

The shaping of a signal to convey information is known as modulation. Modulation can be used to represent a digital message as an analogue waveform. This is known as keying and several keying techniques exist (these include phase-shift keying, frequency-shift keying and amplitude-shift keying). Bluetooth, for example, uses phase-shift keying to exchange information between devices.

Modulation can also be used to transmit the information of analogue signals at higher frequencies. This is helpful because low-frequency analogue signals cannot be effectively transmitted over free space. Hence the information from a low-frequency analogue signal must be superimposed on a higher-frequency signal (known as a carrier wave) before transmission. There are several different modulation schemes available to achieve this (two of the most basic being amplitude modulation and frequency modulation). An example of this process is a DJ's voice being superimposed on a 96 MHz carrier wave using frequency modulation (the voice would then be received on a radio as the channel «96 FM»).

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

receiver, radio broadcast, transmission medium, transceiver, point-to-point communication, discrete value, noise resistance, attenuation, time-division multiplexing, keying, bluetooth

Exercise 2. Answer the questions:
1. What elements does a communication system consist of?
2. What is a network?
3. What can modulation be used for?
4. How is the information encoded in a digital signal?

Exercise 3. Match the left part with the right:

1. Repeaters may be necessary	a) will be degraded by noise.
2. Bluetooth uses phase-shifting keying	b) to amplify or recreate the signal.
3. During transmission the information contained in analogue signal	c) is called broadcast communications.
4. Telecommunications through radio broadcasts	d) to exchange information between devices.

Exercise 4. Open the brackets using the right words:

An example of this process is (a DJ's voice /a DJ's face) being superimposed on a 96 MHz carrier wave using (frequency /current) modulation.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **analogue signal; channel; modulation; telecommunication system; repeater** using the suggested words and expressions as in example:

analogue signal is varied; with respect to; transmission; degraded by noise **Example:** In an analogue signal, the signal is varied continuously with respect to the information. During transmission the information contained in analogue signals will be degraded by noise.

channel transmission medium; multiple stream; may broadcast; has been divided; a separate frequency

modulation can be used; analogue signal; helpful; over free space

telecommunication system basic elements; converts; carries the signal; a receiver; usable information

repeater both types of networks; to amplify; over long distances; to combat attenuation; from noise

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: Telecommunication over a phone line is called point-to-point communication.
2. Question: _____ ?
Answer: The shaping of a signal to convey information is known as modulation.
3. Question: _____ ?
Answer: There are several different modulation schemes available.

4.Question: _____ ?

Answer: In an analogue signal, the signal is varied continuously with respect to the information. In a digital signal, the information is encoded as a set of discrete values (for example ones and zeros).

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **exist**; **shift**; **to represent**; **frequency**; **waveform**; **keying**.

Modulation can be used _____ a digital message as an analogue _____ .This is known as _____ and several keying techniques _____ (these include phone-shift keying, _____ -shift keying, and amplitude-_____ keying).

Exercise 2. Compose a story on one of the topics (up to 40 words):

«Characteristics of analogue and digital signals»
«Types of networks»
«The role of modulation in information transmission»

T e x t 2

TELECOMMUNICATIONS. TELEPHONE

THE READING MODULE

Read the text:

Optical fibre provides cheaper bandwidth for long distance communication. In an analogue telephone network, the caller is connected to the person he wants to talk to by switches at various telephone exchanges. The switches form an electrical connection between the two users and the setting of these switches is determined electronically when the caller dials the number. Once the connection is made, the caller's voice is transformed to an electrical signal using a small microphone in the caller's handset. This electrical signal is then sent through the network to the user at the other end where it transformed back into sound by a small speaker in that person's handset. There is a separate electrical connection that works in reverse, allowing the users to converse.

The fixed-line telephones in most residential homes are analogue — that is, the speaker's voice directly determines the voltage of signal. Although short-distance calls may be handled from end-to-end as analogue signals, increasingly telephone service providers are transparently converting the signals to digital for transmission before converting them back to analogue for reception. The advantage of this is that digitized voice data can travel side-by-side with data from the Internet and can be

perfectly reproduced in long distance communication (as opposed to analogue signals that are inevitably impacted by noise).

Mobile phones have had a significant impact on telephone networks. Mobile phone subscriptions now outnumber fixed-line subscriptions in many markets. Sales of mobile phones in 2005 totalled 816.6 million, with that figure being almost equally shared amongst the markets of Asia/Pacific (204 m), Western Europe (164 m), CEMEA (Central Europe, the Middle East and Africa) (153.5 m), North America (148 m) and Latin America (102 m). In terms of new subscriptions over the five years from 1999, Africa has outpaced other markets with 58.2 % growth. Increasingly these phones are being serviced by systems where the voice content is transmitted digitally such as GSM or W-CDMA with many markets choosing to depreciate analogue systems such as AMPS.

There have also been dramatic changes in telephone communication behind the scenes. Starting with the operation of TAT-8 in 1988, the 1990s saw the widespread adoption of systems based on optic fibres. The benefit of communicating with optic fibres is that they offer a drastic increase in data capacity. TAT-8 itself was able to carry 10 times as many telephone calls as the last copper cable laid at that time and today's optic fibre cables are able to carry 25 times as many telephone calls as TAT-8. This increase in data capacity is due to several factors: First, optic fibres are physically much smaller than competing technologies. Second, they do not suffer from crosstalk which means several hundred of them can be easily bundled together in a single cable. Lastly, improvements in multiplexing have led to an exponential growth in the data capacity of a single fibre.

Assisting communication across many modern optic fibre networks is a protocol known as Asynchronous Transfer Mode (ATM). The ATM protocol allows for the side-by-side data transmission mentioned in the second paragraph. It is suitable for public telephone networks because it establishes a pathway for data through the network and associates a traffic contract with that pathway. The traffic contract is essentially an agreement between the client and the network about how the network is to handle the data; if the network cannot meet the conditions of the traffic contract it does not accept the connection. This is important because telephone calls can negotiate a contract so as to guarantee themselves a constant bit rate, something that will ensure a caller's voice is not delayed in parts or cut-off completely. There are competitors to ATM, such as Multiprotocol Label Switching (MPLS), that perform a similar task and are expected to supplant ATM in the future.

I. Reading exercise:

Exercise1. Read and memorize using the dictionary:

optical fibre, caller, fixed-line telephone, reception, digitized voice data, long distance communications, subscription, voice content, data capacity, multiplexing, data transmission, constant bit rate

Exercise 2. Answer the questions:

1. What is the role of switches in an analogue telephone network?
2.What is the advantage of analogue-to-digital and digital-to-analogue conversion?
3. How can you characterize the world mobile telephone market?
4. What is the benefit of communicating with optic fibres?

Exercise 3. Match the left part with the right:

1. The traffic contract is an agreement	a) is transformed to an electric signal.
2. If the connection is made the caller's voice	b) saw the widespread adoption of systems based on optic fibres.
3. Starting with the operation of TAT-8 in 1988, the 1990s	c) through the network to the user at the other end.
4. The electric signal is then sent	d) between the client and the network.

Exercise 4. Open the brackets using the right words:

TAT-8 itself was able (to carry /to convert) 10 times as many telephone calls as the last (iron /copper) cable laid at that time and today's optic fibre cables are (able /unable) to carry 25 times as many telephone (calls /networks) as TAT-8.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **switch; mobile telephone subscription; Asynchronous Transfer Mode; fixed-line telephone; optic fibre** using the suggested words and expressions as in example:

switch
analogue telephone network; is connected; telephone exchange; two users; the caller dials
Example:
In an analogue telephone network, the caller is connected to the person he wants to talk to by switches at various telephone exchanges. The switches form an electrical connection between the two users and the setting of these switches is determined electronically when the caller dials the number.

mobile telephone subscription
a significant impact; outnumber; figure; the markets of Asia/Pacific; over

the five years; has outpaced

Asynchronous Transfer Mode modern optic-fibre networks, allows for; public telephone network; a pathway; traffic contract

fixed-line telephone residential homes; determines; short-distance calls; as analogue signals; telephone service provider; to digital

optic fibre the widespread adoption; the benefit; offer; data capacity

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: Digitized voice data can be reproduced in long distance communication.

2. Question: _____ ?

Answer: The electrical signal is transformed back into sound by a small speaker in a person's handset.

3. Question: _____ ?

Answer: These phones are serviced by systems where the voice content is transmitted digitally.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **connection; agreement; conditions; to handle.**

The traffic contract is essentially an _____ between the client and the network about how the network is _____ the data; if the network cannot meet the _____ of the traffic contract it does not accept the _____ .

Exercise 2. Fill in the table with words and expressions from the text:

	Chemical elements	Parts	Signals
Example: The electric signal is transformed		by a small speaker in a person's handset.	

Telephone service providers convert			
TAT-8 can carry 10 times as many as telephone calls as			
The caller's voice is transformed to			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«Mobile phones and world market»
«The advantage of converting the signals»
«Asynchronous Transfer Mode Protocol»

T e x t 3

TELECOMMUNICATIONS. RADIO AND TELEVISION. DIGITAL TELEVISION STANDARDS AND THEIR ADOPTION WORLDWIDE

THE READING MODULE

Read the text:

In a broadcast system, a central high-powered broadcast tower transmits a high-freqency electromagnetic wave to numerous low-powered receivers. The high-frequency wave sent by the tower is modulated with a signal containing visual or audio information. The antenna of the receiver is then tuned so as to pick up the high-frequency wave and a demodulator is used to retrieve the signal containing the visual or audio information. The broadcast signal can be either analogue (signal is varied continuously with respect to the information) or digital (information is encoded as a set of discrete values).

The broadcast media industry is at a critical turning point in its development, with many countries moving from analogue to digital broadcasts. This move is made possible by the production of cheaper, faster and more capable integrated circuits. The chief advantage of digital broadcasts is that they prevent a number of complaints with traditional analogue broadcasts. For television, this includes the elimination of problems such as snowy pictures, ghosting and other distortion. These occur because of the nature of analogue transmission, which means that perturbations due to noise will be evident in the final output. Digital transmission overcomes this problem because digital signals are reduced to discrete values upon reception and hence small perturbations do not affect the final output. In a simplified example, if a binary message 1011 was transmitted with signal amplitudes [1.0 0.0 1.0 1.0] and received with signal amplitudes [0.9 0.2 1.1 0.9]

it would still decode to the binary message 1011 — a perfect reproduction of what was sent. From this example, a problem with digital transmissions can also be seen in that if the noise is great enough it can significantly alter the decoded message. Using forward error correction a receiver can correct a handful of bit errors in the resulting message but too much noise will lead to incomprehensible output and hence a breakdown of the transmission.

In digital television broadcasting, there are three competing standards that are likely to be adopted worldwide. These are the ATSC, DVB and ISDB standards; the adoption of these standards thus far is presented in the captioned map. All three standards use MPEG-2 for video compression. ATSC uses Dolby Digital AC-3 for audio compression, ISDB uses Advanced Audio Coding (MPEG-2 Part 7) and DVB has no standard for audio compression but typically uses MPEG-1 Part 3 Layer 2. The choice of modulation also varies between the schemes. In digital audio broadcasting, standards are much more unified with practically all countries choosing to adopt the Digital Audio Broadcasting standard (also known as the Eureka 147 standard). The exception being the United States which has chosen to adopt HD Radio. HD Radio, unlike Eureka 147, is based upon a transmission method known as in-band on-channel transmission that allows digital information to «piggyback» on normal AM or FM analogue transmissions.

However, despite the pending switch to digital, analogue receivers still remain widespread. Analogue television is still transmitted in practically all countries. The United States had hoped to end analogue broadcasts on December 31, 2006; however, this was recently pushed back to February 17, 2009. For analogue television, there are three standards in use. These are known as PAL, NTSC and SECAM. For analogue radio, the switch to digital is made more difficult by the fact that analogue receivers are a fraction of the cost of digital receivers. The choice of modulation for analogue radio is typically between amplitude modulation (AM) and frequency modulation (FM). To achieve stereo playback, an amplitude modulated subcarrier is used for stereo FM.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

broadcast tower, low-powered receiver, broadcast media industry, distortion, discrete values, binary message, forward error correction, digital audio broadcasting, in-band on-channel transmission, stereo playback

Exercise 2. Answer the questions:

1. What type of information does a signal contain?
2. What is the chief advantage of digital broadcast?
3. What are three standards adopted worldwide?

4. Why is the switch to digital receivers made more difficult for analogue radio?

Exercise 3. Match the left part with the right:

1. HD Radio unlike Eureka 147 is based upon	a) on December 31, 2006.
2. The United States had hoped to end analogue broadcasts	b) a receiver can correct a handful of bit errors in the resulting message.
3. Using forward error correction	c) the elimination of problems of distortion are included.
4. For television	d) a transmission method known as in-band on-channel transmission.

Exercise 4. Open the brackets using the right words:

ATSC uses Dolby Digital AC-3 for audio (transmission /compression), ISDB uses Advanced Audio (Coding /Decoding) (MPEG-2 Part 7) and DVB has no standard for (video /audio) compression but typically uses MPEG-1 Part 3 Layer 2.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **integrated circuit; noise; demodulator; binary message; amplitude modulation** using the suggested words and expressions as in example:

integrated circuit
broadcast media industry; development; from analogue to digital broadcast; possible; more capable
Example:
The broadcast media industry is at a critical turning point in its development with many countries moving from analogue to digital broadcast. This is made possible by the production of more capable integrated circuits.

noise
distortion; nature; perturbations; final output

demodulator
the antenna; is tuned; high-frequency wave; to retrieve; containing; information

binary message simplified example; with signal amplitude; would decode; reproduction

amplitude modulation the choice; between; stereo playback; subcarrier; stereo FM

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: For analogue television there are three standards in use.
2. Question: _____ ?
Answer: If the noise is great enough it can significantly alter the decoded message.
3. Question: _____ ?
Answer: The choice of modulation also varies between the schemes.
4.Question:_____?
Answer: Analogue television is still transmitted in practically all countries.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **information; high-powered; tower; high-frequency; receivers.**
In a broadcast system, a central _____ broadcast tower transmits a _____ electromagnetic wave to numerous low-powered _____. The high-frequency wave sent by the _____ is modulated with a signal containing visual or audio _____.

Exercise 2. Fill in the table with words and expressions from the text:

	Method	Distortion	Standards
Example: Digital broadcast includes the elimination of		snowy pictures, ghosting.	
Radio is based upon			
ISDB uses			
All countries adopt			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«The advantages of Digital Broadcast»
«Three competing standards adopted worldwide»
«The destiny of analogue television»

T e x t 4

TELECOMMUNICATIONS. THE INTERNET. THE *OSI* REFERENCE MODEL

THE READING MODULE

Read the text:

The Internet is a worldwide network of computers and computer networks that can communicate with each other using the Internet Protocol. Any computer on the Internet has a unique IP address that can be used by other computers to route information to it. Hence, any computer on the Internet can send a message to any other computer using its IP address. These messages carry with them the originating IP address of computer allowing for two-way communication. In this way, the Internet can be seen as an exchange of messages between computers.

An estimated 16.9 % of the world population has access to the Internet with the highest access rates (measured as a percentage of the population) in North America (69.7 %), Oceania/Australia (53.5 %) and Europe (38.9 %). In terms of broadband access, England (89 %), Iceland (26.7 %), South Korea (25.4 %) and the Netherlands (25.3 %) lead the world.

The Internet works in part because of protocols that govern how the computers and routers communicate with each other. The nature of computer network communication lends itself to a layered approach where individual protocols in the protocol stack run more-or-less independently of other protocols. This allows lower-level protocols to be customized for the network situation while not changing the way higher-level protocols operate a practical example of why this is important is because it allows an Internet browser to run the same code regardless of whether the computer it is running on is connected to the Internet through an Ethernet or Wi-Fi connection. Protocols are often talked about in terms of their place in the OSI reference model, which emerged in 1983 as the first step in an unsuccessful attempt to build a universally adopted networking protocol suite.

For the Internet, the physical medium and data link protocol can vary several times as packets traverse the globe. This is because the Internet places no constraints on what physical medium or data link protocol is used. This leads to the adoption of media and protocols that best suit the local network situation. In practice, most intercontinental communication will use the Asynchronous Transfer Mode (ATM) protocol (or a modern equivalent) on top of optic fibre. This is because for most intercontinental communication the Internet shares the same infrastructure as the public switched telephone network.

At the network layer, things become standardized with the Internet Protocol (IP) being adopted for logical addressing. For the World Wide Web, these «IP addresses»

are derived from the human readable form using the Domain Name System (e.g. 72.14.207.99 is derived from www.google.com). At the moment, the most widely used version of the Internet Protocol is version four but a move to version six is imminent.

At the transport layer, most communication adopts either the Transmission Control Protocol (TCP) or the User Datagram Protocol (UDP). TCP is used when it is essential every message sent is received by the other computer where as UDP is used when it is merely desirable. With TCP, packets are retransmitted if they are lost and placed in order before they are presented to higher layers. With UDP, packets are not ordered or retransmitted if lost. Both TCP and UDP packets carry port numbers with them to specify what application or process the packet should be handled by. Because certain application-level protocols use certain ports, network administrators can restrict Internet access by blocking the traffic destined for a particular port.

Above the transport layer, there are certain protocols that are sometimes used and loosely fit in the session and presentation layers, most notably the Secure Sockets Layer (SSL) and Transport Layer Security (TLS) protocols. These protocols ensure that the data transferred between two parties remains completely confidential and one or the other is in use when a padlock appears at the bottom of your web browser. Finally, at the application layer, there are many of the protocols Internet users would be familiar with such as HTTP (web browsing), POP3 (e-mail), FTP (file transfer), IRC (Internet chat), BitTorrent (file sharing) and OSCAR (instant messaging).

I. **Reading exercises:**

Exercise1. Read and memorize using the dictionary:

network, two-way communication, access rate, router, lower-level protocol, OSI reference model, data link protocol, optic fibre, public switched telephone network, Domain Name system, port number, secure sockets layer protocol, padlock

Exercise 2. Answer the questions:

1. Why does Internet work in part?
2. What percentage of population has access to Internet?
3. How can the Internet communicate computer networks?
4. What are IP addresses derived from?

Exercise 3. Match the left part with the right:

1. The physical medium and data link protocol	a) as an exchange of message between computers.
2. In terms of broadband access	b) can vary several times as packets traverse the globe.
3. The Internet can be seen	c) that the data transferred between two parties remains

	confidential.
4. These protocols ensure	d) England, Iceland, South Korea and the Netherlands lead the world.

Exercise 4. Open the brackets using the right words:

Hence, any computer on the Internet can send (a message /a signal) to any other computer using its (IP address /telephone number). These (digits /messages) carry with them the originating computer's IP address allowing for (one-way /two-way) communication.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **protocol**; **IP address; Internet browser; User Datagram Protocol; frequency modulation** using the suggested words and expressions as in example:

protocol
the nature; leads; layered approach; in the protocol stack; independently
Example:
The nature of computer network communication lends itself to a layered approach where individual protocols in the protocol stack run more-or-less independently of other protocols.

IP address
messages; originating; two-way communication; can be seen; between computers

Internet browser
this is important; it allows; the same code; is connected to; Wi-Fi connection

User Datagram Protocol
Transport layer; adopts; is used; desirable; are not ordered; lost

frequency modulation
choice; analogue radio; stereo playback; subcarrier

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: The nature of computer network communication lends itself to a layered approach.

2. Question: _____ ?

Answer: Most intercontinental communication will use the Asynchronous Transfer Mode protocol.

3. Question: _____ ?

Answer: There are certain protocols that are sometimes used and fit in the session and presentation layers.

4.Question: _____ ?

Answer: Both TCP and UDP packets carry port numbers to specify what application or process the packet should be handled by.

THE WRITING MODULE

III.Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **adopted; model; attempt; emerged.**

Protocols are often talked about in terms of their place in the OSI reference _____, which _____ in 1983 as the first step in an unsuccessful _____ to build a universally _____ networking protocol suite.

Exercise 2. Fill in the table with words and expressions from the text:

	Protocol	IP address	Network
Example: Things become standardized with	the Internet protocol.		
Any computer on the Internet has			
The Internet works in part			
The Internet is			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«The role of protocols in the Internet communication»
«The World Wide Web»
«Layered approach»

T e x t 5

TELECOMMUNICATIONS.
LOCAL AREA NETWORKS

THE READING MODULE

Read the text:

Despite the growth of the Internet, the characteristics of local area networks (computer networks that run at most a few kilometres) remain distinct. This is because networks on this scale do not require all the features associated with larger networks and are often more cost-effective and efficient without them.

In the mid-1980s, several protocol suites emerged to fill the gap between the data link and applications layer of the OSI reference model. These were AppleTalk, IPX and NetBIOS, with the dominant protocol suite during the early 1990s being IPX due to its popularity with MS-DOS users. TCP/IP existed at this point but was typically used by large government and research facilities. As the Internet grew in popularity and a larger percentage of traffic became Internet-related, local area networks gradually moved towards TCP/IP and today networks mostly dedicated to TCP/IP traffic are common. The move to TCP/IP was helped by technologies such as DHCP that allowed TCP/IP clients to discover their own network address — a functionality that came standard with the AppleTalk/IPX/NetBIOS protocol suites.

It is at the data link layer though which most modern local area networks diverge from the Internet. Whereas Asynchronous Transfer Mode (ATM) or Multiprotocol Label Switching (MPLS) are typical data link protocols for larger networks, Ethernet and Token Ring are typical data link protocols for local area networks. These protocols differ from the former ones because they are simpler (e.g. they omit features such as Quality of Service guarantees) and offer collision prevention. Both of these differences allow for more economic set-ups.

Despite the modest popularity of Token Ring in the 80's and 90's, virtually all local area networks now use wired or wireless Ethernet. At the physical layer, most wired Ethernet implementations use copper twisted-pair cables (including the common 10BASE-T networks). However, some early implementations used coaxial cables and some recent implementations (especially high-speed ones) use optic fibres. Optic fibres are also likely to feature prominently in the forthcoming 10-gigabit Ethernet implementations. Where optic fibre is used, the distinction must be made between multi-mode fibre and single-mode fibre. Multi-mode fibre can be thought of as thicker optical fibre that is cheaper to manufacture but that suffers from less usable bandwidth and greater attenuation (i.e. poor long-distance performance).

1. **Reading exercises:**

Exercise1. Read and memorize using the dictionary:

gap, data link, OSI reference model protocol suite, Token Ring, wired and wireless Ethernet, copper twisted-pair cableoptic fibre, 10-gigabit Ethernet, multi-mode fibre, single-mode fibre, attenuation

Exercise 2. Answer the questions:

1. Why do the characteristics of local area networks remain distinct?
2. What are typical data link protocols for larger networks?
3. What types of cables are used for Ethernet implementation?
4. What did several protocol suites emerge for?

Exercise 3. Match the left part with the right:

1. Some early implementations	a) though that most modern local area networks diverge from the Internet.
2. It is at the data link layer	b) local area networks moved towards TCP/IP.
3. As the Internet grew in popularity	c) to feature in the forth-coming 10-gigabit Ethernet.
4. Optic fibres are likely	d) used coaxial cables.

Exercise 4. Open the brackets using the right words:

Despite the growth of the (electrical network /Internet), the characteristics of (local /worldwide) area networks (computer networks that run at most (a few /a lot of) kilometres) remain distinct. This is because networks on this scale do not (exclude /require) all the features associated with larger networks and are often more cost-effective and efficient (without /with) them.

THE SPEAKING MODULE

I. Speaking exercises:

Exercise 1. Describe **OSI reference model; collision prevention; multi-mode fibre; local area network; data link layer** using the suggested words and expressions as in example:

OSI reference model
mid-1980s; emerged, the data link; dominant protocol suite; its popularity
Example:
In the mid-1980s, several protocol suites emerged to fill the gap between the data link and applications layer of the OSI reference model. These were AppleTalk, IPX and NetBIOS, with the dominant protocol suite during the early 1990s being IPX due to its popularity with MS-DOS users.

collision prevention
differ from; simpler; omit features; offer

multi-mode fibre
optic fibres; to feature; 10-gigabit Ethernet implementations; distinction

local area network
characteristics; run; distinct; on this scale; features; cost-effective

data link layer
diverge; the Internet; typical data link protocol; larger network

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: Local area networks gradually moved towards TCP/IP.
2. Question: _____ ?
Answer: Both of the differences in protocols allow for more economic set-ups.
3. Question: _____ ?
Answer: Multi-mode fibre suffers from less usable bandwidth and greater attenuation.
4. Question: _____ ?
Answer: In the mid-1980s, several protocol suites emerged to fill the gap between the data link and applications layer of the OSI reference model.

THE WRITING MODULE

II. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **suites; TCP/IP; address**; **standard; allowed.**
The move to _____ was helped by technologies such as DHCP that _____ TCP/IP clients to discover their own network _____ — a functionality that came _____ with the AppleTalk/IPX/NetBIOS protocol _____ .

Exercise 2. Fill in the table with words and expressions from the text:

	Fibre	Protocol	Cost
Example: The distinction must be made between	multi-mode fibre and single-mode fibre.		
All local area networks now use			
Thicker optical fibre is			
Computer networks that run at a few kilometers are			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«Protocols used for local area networks»
«Modern channel for information transmission»
«Differences between local area network and larger network protocols»

T e x t 6

WHAT IS MPEG?

THE READING MODULE

Read the text:

MPEG (Moving Picture Experts Group) is an International Standards Organization (ISO) group which sets standards for compressing and storing video, audio, and animation in digital form.

Moving Picture Experts Group's first meeting was in Ottawa, Canada, in May of 1988. Over the years, MPEG has developed to include around 350 members per meeting from several industries, research institutions, and universities. The official designation of Moving Picture Experts Group is ISO/IEC JTC1/SC29 WG11.

Pronounced «m-peg», the term MPEG represents the entire digital video compression techniques and the digital file formats created by the Moving Picture Experts Group. Generally, MPEG can create high quality video files when compared with other competing formats like Video for Windows, QuickTime, and Indeo. MPEG files can be decoded with the help of software programs or by using special hardware.

MPEG files attain high compression rates by only storing the changes which occur between two frames, rather than storing the entire frame. The technique used by MPEG to encode video information is known as DCT. Much like JPEG, MPEG utilizes a lossy

compression technique in which certain data is removed from the files. However, end users cannot normally notice a reduction in quality as the reduction of data is hardly noticeable to the human eye.

MPEG Standards

Though there are several MPEG standards, MPEG-1, MPEG-2, and MPEG-4 are three most popular MPEG standards:

MPEG-1: MPEG-1, the first video and audio compression standard, supports a video resolution of 352x240 at the rate of 30 fps (frames per second). However, the video quality of MPEG-1 is slightly lower than the video quality offered by a normal VCR. MPEG-1 also has the ability to include audio compressed in the MP3 audio format.

MPEG-2: MPEG-2 can support video resolutions of 720x480 and 1280x720 at 60 frames per second, with an audio quality equal to conventional CD audio. MPEG-2 is suitable for almost all television standards, including ATSC, NTSC and HDTV. MPEG-2 has the capability to reduce a two hour video file to a few gigabytes of data. Encoding video to MPEG-2 requires fairly significant processing power. The MPEG-2 standards are also used to store data on DVD's.

MPEG-4: Introduced in late 1998, MPEG-4 is based on MPEG-1, MPEG-2, and Apple QuickTime technology. This graphics and video compression algorithm standard comes with the ability to create wavelet-based files which are smaller than QuickTime or JPEG files. MPEG-4 files are designed so as to transmit images and video while using less network bandwidth. MPEG-4 files can combine video with graphics, text, and 2-D and 3-D animation layers.

Additional features which can be seen in MPEG-4 include object oriented composite files (such as video, audio, and VRML objects), VRML support for 3D rendering, and support for externally specified DRM (Digital Rights Management).

Other MPEG standards

MPEG-3: MPEG-3 was originally developed for HDTV; but as the MPEG-2 standard was found to be more efficient for HDTV, MPEG-3 was abandoned.

MPEG-7: MPEG-7 is a formal standard for illustrating multimedia content.

MPEG-21: MPEG-21 is designed to share machine-readable license information in a «ubiquitous, unambiguous and secure» manner.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

compressing video, digital video compression technique, hardware, reduction of data, video resolution, CD audio, compression algorithm, image, network bandwidth, object oriented composite file, multimedia content

Exercise 2. Answer the questions:

1. What can you say about Moving Picture Experts Group?
2. What are the most popular MPEG standards?
3. How was MPEG-3 developed?
4. When was MPEG-4 introduced?

Exercise 3. Match the left part with the right:

1. MPEG files can be decoded	a1) video resolution of 720x480 and 1280x720 at 60 frames per second.
2. MPEG-1 has the ability	b) with the help of software programs or by using special hardware.
3. MPEG-2 can support	c) comes with the ability to create wavelet-based files.
4. This graphics and video compression algorithm standard	d) to include audio compressed in the MP3 audio format.

Exercise 4. Open the brackets using the right words:

End users cannot (normally /perfectly) notice a reduction in (quantity /quality) as the reduction of data is hardly (noticeable /irritating) to the human eye.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **video file; video resolution; high compression rate; compression algorithm; MPEG-2** using the suggested words and expressions as in example:

video file MPEG; high quality; competing format; decoded; software programs **Example**: MPEG can create high quality video files when compared with other competing formats like Video for Windows, QuickTime, and Indeo. MPEG files can be decoded with the help of software programs or by using special hardware.
video resolution compression standard; at the rate; video quality; lower than; offered by

high compression rate MPEG files; storing; between frames; entire frame

compression algorithm graphics; standard; ability; smaller than

MPEG-2 can support; 60 frames per second; equal to; suitable; television standards

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: Moving Picture Experts Group is an International Standards Organization group which sets standards for compressing and storing video, audio, and animation in digital form.
2. Question: _____ ?
Answer: Three MPEG standards are most popular ones.
3. Question: _____ ?
Answer: MPEG-4 is based on MPEG-1, MPEG-2 and Apple Quick Time technology.
4. Question: _____ ?
Answer:Additional features which can be seen in MPEG-4 include object oriented composite files (such as video, audio, and VRML objects), VRML support for 3D rendering, and support for externally specified DRM (Digital Rights Management).

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **two; MPEG; high; storing.**
MPEG files attain _____ compression rates by only _____ the changes which occur between _____ frames, rather than storing the entire frame. The technique used by _____ to encode video information is known as DCT.

Exercise 2. Fill in the table with words and expressions from the text:

	Standard	Resolution	Size
Example: An International Standards Organization group sets	Standards for compressing and storing video, audio.		
MPEG-2 can support			

MPEG-2 is suitable for almost			
MPEG-4 comes with the ability to create			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«The history of appearing MPEG standards»
«The characteristics of MPEG»
«The differences between MPEG-1,-2,-4»

T e x t 7

WHAT IS A DVD-RECORDER?

THE READING MODULE

Read the text:

The best way to understand DVD-recorders is to compare them with VCRs. They are similar both in shape, function and features. You can say about a DVD recorder that it's an optical disk recorder that uses a laser beam to write media on a blank DVD. Usually the term of DVD recorder is applied to standalone units that are used in home theater systems, in studios, etc, but there are other types of DVD recorders and DVD recorder combos out there. For example DVD recorders mounted in a computer are referred to as DVD burners, and in many home theater systems you will find standalone DVD recorders that have an integrated hard-drive.

But there is far more to DVD recorders than that. DVD recorders are now equipped with a number of features that make the DVD recorder a true media device. DVD recorders can record from analog video sources and most of them can also record from digital sources via FireWire ports. So most DVD recorders today have included ATSC (HDTV) tuners, used to record media directly from a TV stream.

In the beginning there were three main formats supported by DVD recorders: DVD-RAM, DVD-RW and DVD+RW. Out of these, DVD-RAM is almost obsolete and is not compatible with most DVD recorders out there today. DVD-RW allows you to write and then rewrite data on the DVD, the only downside is that you have to erase the whole disk if you want to modify stored data. Last but not least, the DVD+RW uses the random write access technology that enables you to write and erase data without having to erase the whole disk. Most DVD recorders today support both DVD-RW and DVD+RW standards.

The speed used by the DVD recorder to write data is measured in «X», similar to CD-ROM speeds measurement system. In this system 1X equals to 1.321 MB/s, which is the equivalent of 9X when comparing to CD-ROM writing speeds. The writing speed is only relevant to DVD burners mounted on a computer, that can write data stored on the hard drive, standalone DVD recorders write data in real time (1X speed).

There are some discussions about the fate of the DVD recorder. Maybe it will become obsolete as happened with the VCR; but there is an opinion that the technical advantages of the DVD recorder will keep in on the market for years to come. For example a DVD recorder has superior audio and video quality, does not need rewinding because it uses a chapter index you can jump to at any time, makes use of playlists, provides multilingual subtitles, etc. Of course there are some downsides such as the fact that DVDs must be finalized in order to be played (this is not true for DVD+RW and DVD-RW disks that allow random write access). Another downside is that the MPEG-2 standards implemented on most DVD recorders today outputs media of a slightly lesser quality than professionally rendered DVDs.

Considering this, a DVD recorder is a much better choice than a VCR and it definitely must have device in your home cinema media center.

I . Reading exercises:

Exercise1. Read and memorize using the dictionary:

home theatre system, DVD burner, integrated hard-drive, media device, ATSC tuner, TV stream, access technology, CD-ROM speech measurement system, rewinding, chapter index, multilingual subtitle, downside, output media

Exercise 2. Answer the questions:

1. What is the difference between DVD recorders and VCRs?
2. What are three main formats supported by DVD recorders?
3. What can you say about the speed of DVD recorders?
4. How long will the DVD recorder keep its position on the market?

Exercise 3. Match the left part with the right:

1. DVD recorders are similar	a) only relevant to DVD burner mounted on a computer.
2. DVD-RAM is almost obsolete	b) both in shape, function and features.
3. The writing speed is	c) support both DVD-RW and DVD+RW standards.
4. Most DVD recorders today	d) is not compatible with the most DVD recorders out there today.

Exercise 4. Open the brackets using the right words:

The DVD+RW uses the random (read /write) access technology that enables you to write and (erase /store) data without having to erase the (part of /whole) disk.

THE SPEAKING MODULE

II.Speaking exercises:

Exercise 1. Describe **optical disk recorder; FireWire ports; random write access technology; CD-ROM speeds measurement system; rewinding** using the suggested words and expressions as in example:

optical disk recorder DVD reorder; uses; to write media; blank DVD **Example**: You can say about a DVD recorder that it's an optical disk recorder that uses a laser beam to write media on a blank DVD.

FireWire ports DVD recorder; analogue video source; can record; digital sources

random write access technology the DVD+RW; enables; erase data; the whole disk; support

CD-ROM speeds measurement system by the DVD recorder; is measured in «X»; equals; is the equivalent; writing speed

rewinding audio and video quality; it uses; at any time; use of playlist; multilingual subtitles

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: The best way to understand DVD recorders is to compare them with VCRs.

2. Question: _____ ?

Answer: Most DVD recorders today have included ATSC tuners.

3. Question: _____ ?

Answer: The only downside of DVD-RW is that you have to erase the whole disk.

4. Question: _____ ?

Answer: A DVD recorder is a much better choice than a VCR and it's definitely must have device in your home cinema media center.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **market; discussions; advantages; become.**

There are some _____ about the fate of the DVD recorder. Maybe it will _____ obsolete as happened with the VCR, but there is an opinion that the technical _____ of the DVD recorder will keep in on the _____ for years to come.

Exercise 2. Fill in the table with words and expressions from the text:

	Parts	Technical advantages	Formats
Example: DVD recorders include	ATSC turners used to record media directly from a TV stream.		
A DVD recorder has			
A DVD recorder supports			
A DVD recorder uses			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«Three main formats of DVD recorders»
«DVD recorder technical advantages»
«A DVD recorder and a VCR»

T e x t 8

HOW MANY TYPES OF MOBILE TELEPHONE SYSTEMS ARE THERE?

THE READING MODULE

Read the text:

The main mobile telephone systems in the last twenty five years were as follows: 1981 Nordic Mobile Telephone (NMT); 1983 Advanced Mobile Phone System (AMPS); 1985 Total Access Communication System (TACS); 1991 American Digital Cellular (ADC); 1991 Global System for Mobile Communication (GSM); 1992 Digital Cellular System (DCS); 1994 Japanese Personal Digital Cellular (PDC); 1995 Personal Communications Service (PCS) - Canada; 1996 Personal Communications Service (PCS) – USA.

Mobile telephone systems are either analog or digital. In analog systems, voice messages are transmitted as sound waves. When you speak into an analog mobile telephone, your voice wave is linked to a radio wave and transmitted. In digital systems, voice messages are transmitted as a stream of zeroes and ones. When you speak into a digital mobile telephone, your voice wave is converted into a binary pattern before being transmitted.

Mobile telephone system all utilizes some method to allow multiple users to share the system concurrently. These three methods for doing this are: FDM Frequency Division Multiplexing; TDMA Time Division Multiple Access; CDMA Code Division Multiple Access.

In a FDM system, the available frequency is divided into channels. Each conversation is given a channel. When the system runs out of channels in a given area, no more telephone calls can be connected. In this way, FDM operates much like the channel button on your television set. The AMPS and NAMPS mobile telephone systems utilize FDM.

In a TDMA system, your encoded voice is digitized and then placed on a radio-frequency (RF) channel with other calls. This is accomplished by allocating time slots to each call within the frequency. In the D-AMPS (Digital AMPS) system, each 30 kHz carrier frequency is divided into three time slots. In the GSM and PCS systems, each 200 kHz carrier is divided into eight time slots. The D-AMPS, D-AMPS 1900, GSM, PCS and IDEN systems all utilize TDMA.

In a CDMA system, your encoded voice is digitized and divided into packets. These packets are tagged with «codes». The packets then mix with all of the other packets of traffic in the local CDMA network as they are routed towards their destination. The receiving system only accepts the packets with the codes destined for it. Analog systems are FDM. Digital systems can utilize either TDMA or CDMA.

FDM systems typically allow one call per 10 kHz or 30 kHz of spectrum. Early TDMA systems tripled the capacity of FDM systems. Recent advances in TDMA promise to provide forty times the carrying capacity of FDM systems. CDMA promises to improve on the results of TDMA.

Before there were cellular telephone systems, there was MTS (Mobile Telephone Service) and IMTS (Improved Mobile Telephone Service). These early systems have ceased operations.

Many mobile telephone systems exist outside the United States, including NMT, TACS/ETACS, and JTACS. New systems are constantly in development.

GSM (Global System for Mobile communication) is a digital mobile telephone system that is widely used in Europe and other parts of the world. GSM uses a variation of Time Division Multiple Access (TDMA) and is the most widely used of the three digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1,800 MHz frequency band.

GSM is the de facto wireless telephone standard in Europe. GSM has over one billion users worldwide and is available in 190 countries. Since many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries.

GSM together with other technologies is part of an evolution of wireless mobile telecommunication that includes High-Speed Circuit-Switched Data (HSCSD), General Packet Radio System (GPRS), Enhanced Data rate for GSM Evolution (EDGE), and Universal Mobile Telecommunications Service (UMTS).

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

stream of zeroes and ones, binary pattern, frequency division multiplexing, time division, multiple access, code division multiple access, time slot, local CDMA network, digital wireless telephone technology

Exercise 2. Answer the questions:

1. What are the differences between analogue and digital mobile telephone systems?
2. What is the principle of FDM system operation?
3. How does a TDMA system run?
4. Where is Global System for Mobile Communication (GSM) used?

Exercise 3. Match the left part with the right:

1. GSM has over one billion users worldwide	a) promise to provide forty times the carrying capacity of FDM

	systems.
2. Recent advances in TDMA	b) outside the United States including NMT, TACS/ETACS and JTACS.
3. In a TDMA system an encoded voice is digitized and then	c) and is available in 190 countries.
4. Many mobile telephone systems exist	d) placed on a radio-frequency (RF) channel with other calls.

Exercise 4. Open the brackets using the right words:

When you speak into (an analog /a digital) mobile telephone, your voice wave is (converted /transferred) into a binary pattern before being transmitted.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **binary pattern; channel button; time slot; local CDMA network**; **cellular telephone** system using the suggested words and expressions as in example:

binary pattern voice messages; zeroes and ones; speak into; voice wave; being transmitted **Example**: In digital systems, voice messages are transmitted as a stream of zeroes and ones. When you speak into a digital mobile telephone, your voice wave is converted into a binary pattern before being transmitted.
channel button FDM (Frequency Division Multiplexing); television set; utilize

time slot is accomplished; to each call; Digital AMPS system; is divided into

local CDMA network the packets; traffic; are routed towards; the receiving system; with the codes

cellular telephone systems MTS; IMTS (Improved Mobile Telephone Service); early systems; operations

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: GSM is a digital mobile telephone system that is widely used in Europe.

2. Question: _____ ?

Answer: FDM system typically allows one call per 10 kHz or 30 kHz per spectrum.

3. Question: _____ ?

Answer: Mobile telephone system all utilize some method to allow multiple users to share the system concurrently.

4. Question: _____ ?

Answer: GSM together with other technologies is part of an evolution of wireless mobile telecommunication that includes High-Speed Circuit-Switched Data (HSCSD), General Packet Radio System (GPRS), Enhanced Data rate for GSM Evolution (EDGE), and Universal Mobile Telecommunications Service (UMTS).

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **slot; variation; streams; three; compresses.**

GSM uses a _____ of Time Division Multiple Access (TDMA) and is the most widely used of the _____ digital wireless telephone technologies (TDMA, GSM, and CDMA). GSM digitizes and _____ data, then sends it down a channel with two other _____ of user data, each in its own time _____ .

Exercise 2. Fill in the table with words and expressions from the text:

	Standard	Wave	Channel
example: Encoded voice is placed			on a radio-frequency (RF) channel with other calls.
GSM is de facto			
Your voice is linked			
Voice message is transmitted			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«Mobile telephone system»
«Global System for Mobile telephone communication»
«Three methods of Mobile telephone system utilization»

T e x t 9

WHAT IS DVI?

THE READING MODULE

Read the text:

DVI (Digital Video Interface) is a video connector designed by the Digital Display Working Group (DDWG), aimed at maximizing the picture quality of digital display devices such as digital projectors and LCD screens.

Previous standards such as Video Graphics Array (VGA) were designed exclusively for CRT-based devices and hence did not take into consideration 'discrete time'. In such standards, the source, while transmitting each horizontal line of the image, varies the output voltage to represent the desired brightness level. This CRT responds to these voltage levels changes by varying the intensity of the electron beam as it scans from one end of the screen to the other.

In digital systems, the brightness value for each pixel needs to be selected so as to display the image properly. The decoder achieves this by sampling the input signal voltage at regular intervals. This technique has some inherent problems. Because these are purely digital signals, there will be some level of distortion if the sample is not taken from the center of the pixel. There is also the possibility of crosstalk interference.

DVI takes an entirely different approach. With DVI, the required brightness level of each pixel is transmitted in a binary code. This way, every pixel in the output buffer of the source device will correspond directly to one pixel of the display device. DVI is free from the noise and distortion inherent in analog signals.

The data format used in DVI is based on the Panel Serial format that uses TMDS (Transition Minimized Differential Signaling). Each of DVI link consists of four twisted pairs of wires (one with a color code of red, blue and green, and one for a clock signal) to transmit 24 bits per pixel. The clock signal is virtually the same as that of the analog video signal, while the picture is sent electronically line by line with blanking intervals separating each line and frame, sans any packetization. DVI also uses no compression, and if a changed part of an image is to be transmitted, then DVI has no choice but to retransmit the entire frame once again.

For a single DVI link, the maximum possible resolution for 60 Hz is 2.6 megapixels. Therefore, DVI connectors are provided with an option to connect a second link if there is a need for more that 2.6 megapixels of resolution. In fact, the DVI specification limits the cutoff point of each link at 165 MHz. Every display mode which may require less than this can use the single link mode, while those exceeding the set limit must switch to the dual link mode. The second link can also be switched on when more than 24 bits per pixel are required, in which case the second link transmits the LSBs.

DVI is the only standard that uses both digital and analog transmission options in the same connector. Most of the competing standards, such as Open LDI and LDVS, are

based exclusively on digital technology. As an extension to the above mentioned point, DVI connectors are classified into DVI-D (DVI Digital), DVI-A (DVI Analog), and DVI-I (Digital and Analog). If there is a provision for a second link, that connector is referred to as DVI-DL (Dual Link).

Some DVD players and television sets come with DVI/HDCP connectors, which, even though are physically same as the DVI connectors, also have the additional ability to transmit a HDCP signal (encrypted) using the HDCP protocol for copyright protection.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

video connector, digital display device, LCD screen, CRT-based device, output voltage, electron beam, brightness value, input signal voltage, pixel, binary code, output buffer, DVI link, resolution, single link mode, transmission option, copyright protection

Exercise 2. Answer the questions:

1. What are the problems of digital systems?
2. What transmission options does DVI use?
3. What is data format based on?
4. How is DVI compared to older technologies?

Exercise 3. Match the left part with the right:

1. DVI is a video connector	a) is based on Panel Serial format that uses TMDS.
2. The data format used in DVI	b) by sampling the input signal voltage at regular interval.
3. The decoder achieves this	c) when more than 24 bits per pixel are required.
4. The second link can be switched on	d) designed by the Digital Display Working Group.

Exercise 4. Open the brackets using the right words:

DVI uses no (compression /approach), and if a changed part of an image is to be (produced /transmitted), then DVI has no choice but to (multiplex /retransmit) the entire frame once again.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **DVI link; DVI connector; pixel; clock signal; distortion level** using the suggested words and expressions as in example:

DVI link
consists of; a color code; clock signal; pixel
Example:
Each DVI link consists of four twisted pair of wires (one with a color code of red, blue and green, and one for a clock signal) to transmit 24 bits per pixel.

DVI connector
extension; are classified into; a provision; is referred to

pixel
brightness level; in a binary code; output buffer; will correspond; the display device

clock signal
analog voice signal; is sent; with blanking intervals; any packetization

distortion level
purely digital signal; the sample; the center of the pixel; the possibility

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: The maximum possible resolution for 60 Hz is 2.6 megapixels.
2. Question: _____ ?
Answer: The source varies the output voltage to represent the desired brightness level.
3. Question: _____ ?
Answer: DVI is free from the noise and distortion inherent in analog signals.
4. Question: _____ ?

Answer: Some DVD players and television sets come with DVI/HDCP connectors.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **digital; standard; competing; options.**
DVI is the only _____ that uses both digital and analog transmission _____ in the same connector. Most of the _____ standards, such as Open LDI and LDVS, are based exclusively on _____ technology.

Exercise 2. Fill in the table with words and expressions from the text:

	Approach	Device	Wire
example: Standards were designed		For CRT-based devices	
Each DVI link consists of			
Every pixel in the output buffer corresponds			
DVI connectors are classified into			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«DVI compared to Older Technologies»
«DVI's technology»
«Combination of DVI connectors and different devices»

T e x t 10

BRIEF OVERVIEW OF OPTIC FIBRE CABLE ADVANTAGES OVER COPPER

THE READING MODULE

Read the text:

Speed: Optic fibre networks operate at high speeds – up into gigabits; bandwidth: large carrying capacity; distance: signals can be transmitted further without needing to be «refreshed» or strengthened; resistance: greater resistance to electromagnetic noise such as radios, motors or other nearby cables; maintenance: optic fibre cable costs much less to maintain.

In recent years it has become apparent that fibre optics is steadily replacing copper wire as an appropriate means of communication signal transmission. They span the long distances between local phone systems as well as providing the backbone for many network systems. Other system users include cable television services, university campuses, office buildings, industrial plants, and electric utility companies.

An optic fibre system is similar to the copper wire system that fibre optics is replacing. The difference is that fibre optics use light pulses to transmit information down fibre lines instead of using electronic pulses to transmit information down copper lines. Looking at the components in an optic fibre chain will give a better understanding of how the system works in conjunction with wire based systems.

At one end of the system there is a transmitter. This is the place of origin for information coming on to optic fibre lines. The transmitter accepts coded electronic pulse information coming from copper wire. It then processes and translates that information into equivalently coded light pulses. A light-emitting diode (LED) or an injection-laser diode (ILD) can be used for generating the light pulses. Using a lens, the light pulses are funneled into the optic fibre medium where they transmit themselves down the line.

Think of a fibre cable in terms of very long cardboard roll (from the inside roll of paper towel) that is coated with a mirror. If you shine a flashlight in one roll you can see light at the far end - even if bent the roll around a corner.

Light pulses move easily down the optic fibre line because of a principle known as total internal reflection. This principle of total internal reflection states that when the angle of incidence exceeds a critical value, light cannot get out of the glass; instead, the light bounces back in. When this principle is applied to the construction of the optic-fibre strand, it is possible to transmit information down fibre lines in the form of light pulses.

There are three types of optic fibre cable commonly used: single mode, multimode and plastic optical fibre (POF).

Transparent glass or plastic fibre which allow light to be guided from one end to the other with minimal loss.

Optic fibre cable functions as a «light guide», guiding the light introduced at one end of the cable through to the other end. The light source can either be a light-emitting diode (LED) or a laser.The light source is pulsed on and off, and a light-sensitive receiver on the other end of the cable converts the pulses back into the digital ones and zeros of the original signal.

Even laser light shining through an optic fibre cable is subject to loss of strength, primarily through dispersion and scattering of the light, within the cable itself. Light strengtheners, called repeaters, may be necessary to refresh the signal in certain applications.

While optic fibre cable itself has become cheaper over time - an equivalent length of copper cable costs less per foot but not in capacity. Optic fibre cable connectors and the equipment needed to install them are still more expensive than their copper counterparts.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

bandwidth, optic fibre chain, light emitting diode (LED), injection-laser diode (ILD), lens, cardboard roll, total internal reflection, critical value, strand, single mode, transparent glass, light-sensitive receiver, dispersion

Exercise 2. Answer the questions:

1. What is the principle of a fibre cable?
2. What can be used as a light source?
3. How can you define the difference between an optic fibre cable and a copper cable?
4. What are the advantages of a fibre cable?

Exercise 3. Match the left part with the right:

1. It is possible to transmit information	a) can be used generating the light pulses.
2. Fibre optics use light pulses	b) down fibre lines in the form of light pulses.
3. An injection-laser diode (ILD)	c) the greater the risk of dispersion.
4. The faster the laser fluctuates	d) instead of using electronics pulses.

Exercise 4. Open the brackets using the right words:

While optic fibre (transmitter /cable) itself has become cheaper over time - an equivalent (length /width) of copper cable costs (more /less) per foot but not in capacity.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **total internal reflection; light-emitting diode; light-sensitive receiver; wire based system; dispersion** using the suggested words and expressions as in example:

total internal reflection principle; the angle of incidence; get out; bounced back **Example**: This principle of total internal reflection states that when the angle of incidence exceeds a critical value, light cannot get out of the glass; instead, the light bounces back in.

light-emitting diode can be used; using a lens; the light pulses; optic fibre medium; transmit down
light-sensitive receiver the light source; on the other end; digital ones and zeroes

wire based system a optic fibre chain; a better understanding; in conjunction

dispersion laser light; is subject; scattering; the faster; the risk

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: The transmitter accepts coded electronic pulse information coming from copper wire.
2. Question: _____ ?
Answer: At one end of the system is a transmitter.
3. Question: _____ ?
Answer: The light source can either be a light-emitting diode (LED) or a laser.
4.Question: _____ ?
Answer: The faster the laser fluctuates, the greater the risk of dispersion.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **backbone; apparent; span; copper; means.**
In recent years it has become _____ that fibre optics is steadily replacing _____ wire as an appropriate _____ of communication signal transmission. They _____ the long distances between local phone systems as well as providing the _____ for many network systems.

Exercise 2. Fill in the table with words and expressions from the text:

	Principle	Device	Pulse
Example: Fibre optics use			light pulses to transmit information down fibre lines
Light-pulses move down the optic fibre line because			
To refresh the signal we use			
Copper wires use			

Exercise 3. Compose a story on one of the topics (up to 40 words):

«The differences between fibre optics and copper wire»
«Characteristics of fibre optics»
«Principle of optic fibre operation»

UNIT 4

SOFTWARE ENGINEERING

T e x t 1

COMPUTER SOFTWARE

THE READING MODULE

Read the text:

Computer software or just software is a general term used to describe a collection of computer programs, procedures and documentation that performs some tasks on a computer system. It plays an important role in computer-based information systems because hardware would be useless without it. Software comprises the instructions that tell hardware what to do. This term includes application software such as word processors that perform productive tasks for users, system software such as operating systems, which interface with hardware to provide the necessary services for application software, and middleware that controls and co-ordinates distributed systems.

Applications software is a collection of related programs designed to perform a specific task - to solve a particular problem for the user. Typical applications include: industrial automation, business software, educational software, medical software, databases, and computer games. Businesses are probably the biggest users of application software, but almost every field of human activity now uses some form of application software.

System software starts up (boots) the computer and functions as the principal coordinator of all the hardware components and applications software programs. It includes: operating systems, device drivers, diagnostic tools, servers, windowing systems, utilities and more. The purpose of system software is to insulate the applications programmer as much as possible from the details of the particular computer complex being used, especially memory and other hardware features, and such as accessory devices as communications, printers, readers, displays, keyboards, etc.

Middleware controls and co-ordinates distributed systems. The software consists of a set of enabling services that allow multiple processes running on one or more machines to interact across the network.

The six major categories of applications software are general business management, industry-specific, special disciplines, education, personal/home management, and general- purpose for the user.

Software includes websites, programs, video games etc. that are coded by programming languages like C, C++, etc.

Computer software encompasses an extremely wide array of products and technologies developed using different techniques like programming languages, scripting languages etc. Software usually runs on a software platform which can either be provided by the

operating system or by OS independent platforms like Java and .NET. Software written for one platform is usually unable to run on other platforms so that for instance, Microsoft Windows software will not be able to run on Mac OS because of the differences relating to the platforms and their own standards. These applications can work using software porting, interpreters or re-writing the source code for that platform.

At the lowest level, software consists of a machine language specific to an individual processor. A machine language consists of groups of binary values signifying processor instructions which change the state of the computer from its preceding state. Software is an ordered sequence of instructions for changing the state of the computer hardware in a particular sequence. It is usually written in high-level programming languages that are easier and more efficient for humans to use (closer to natural language) than machine language. High-level languages are compiled or interpreted into machine language object code. Software may also be written in an assembly language, essentially, a mnemonic representation of a machine language using a natural language alphabet. Assembly language must be assembled into object code via an assembler.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

middleware, diagnostic tools, accessory devices, utilities, to insulate, binary values, scripting languages, to encompass, to compile, interpret, mnemonic, multiple, software porting

Exercise 2. Answer the questions:

1. What is computer software, application software, system software, middleware?
2. What are six major categories of applications?
3. What does the software at the lowest level consist of?
4. What are high-level languages compiled into?

Exercise 3. Match the left part with the right:

1. Software plays an important role in computer-based information system because	a) the applications programmer from the details of the particular computer complex being used.
2. The purpose of system software is to insulate	b) a machine language object code.
3. At the lowest level, software consists of	c) a machine language specific to an individual processor.
4. High-level languages are compiled or interpreted into	d) hardware would be useless without it.

Exercise 4. Open the brackets using the right words:

Software comprises the instructions that tell (the hardware/ the middleware/ the printer) what to do.

Systems software (starts up/ damages) the computer and functions as the principal coordinator of all the (program/ hardware/ peripheral) components and applications software programs.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **computer software; application software; systems software; middleware, the purpose of systems software** using the suggested words and expressions as in example:

computer software a general term, computer programs, procedures, computer system, hardware, useless, comprises, instructions **Example:**Computer software or just software is a general term used to describe a collection of computer programs, procedures and documentation that perform some tasks on a computer system. It plays an important role in computer-based information systems because hardware would be useless without it. Software comprises the instructions that tell the hardware what to do.
application software collection, to perform, specific task, include, industrial automation, business software, educational software, medical software, databases, computer game
systems software the principal co-ordinator, hardware components, operating systems, device drivers, diagnostic tools, servers, windowing systems, utilities, boot
middleware co-ordinate, distributed systems, a set of enabling services, multiple processes, machines, to interact, a network
the purpose of systems software insulate, applications programmer, particalar computer complex, memory, hardware features, accessory devices, communications, printers, readers, displays, keyboards

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: Applications software is a collection of related programs designed to solve a particular problem for the user.

2. Question: _____ ?

Answer: A machine language consists of groups of binary values signifying processor instructions.

3. Question: _____ ?

Answer: Software includes websites, programs, video games etc. that are coded by programming languages like C, C++.

4. Question: _____ ?

Answer: Software may also be written in an assembly language, essentially, a mnemonic representation of a machine language using a natural language alphabet.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **object code, processor, hardware components, binary values.**

At the lowest level, software consists of a machine language specific to an individual_____ A machine language consists of groups_____ of signifying processor instructions which change the state of the computer from its preceding state. High-level languages are compiled or interpreted into a machine language_____ Systems software starts up the computer and functions as the principal coordinator of all the _____and applications software programs

Exercise 2. Fill in the table with words and expressions from the text:

	Application Software	Software Composition	Langua ge
Example: Application software is a collection of	related programs		
Software sonsists of			
A machine language			
Software may also be written			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«History of computer software».

«Software industry».

«Quality and reliability of software».

T e x t 2

SYSTEM SOFTWARE

THE READING MODULE

Read the text:

System software is any computer software that manages and controls computer hardware so that application software can perform a task. System software helps run the computer hardware and computer system. System software is a software that basically makes the computer work. Examples beside operation systems are anti-virus software, communication software and printer drivers. Without the system software a computer doesn't work. The part of the operating system that resides in main memory (internal instructions) is the most important; without these instructions, a computer cannot operate. These instructions must be loaded from storage when the computer is first turned on (called booting for microcomputers and initial program load for mainframes) — otherwise, none of the hardware components will function. Internal instructions must reside in main memory at all times while the computer is on. External command instructions perform so-called housekeeping tasks, which frequently have to do with «desktop» management and file and storage management. System software performs tasks like transferring data from memory to disk, or rendering a text onto a display device. It includes: operating systems, device drivers, diagnostic tools, servers, windowing systems, utilities and more. System Software can be classified as operating system and language processors.

Operating system creates an interface between user and the system hardware. Language processors are those that help to convert computer language to the machine level language.

Some low-level languages, called assembly languages, were created using abbreviations to help programmers avoid the tedious and time-consuming task of writing programs in machine language (0s and 1s). High-level languages were developed to make the job even easier. However, both high-level and assembly languages must be translated into machine language for the CPU to use them. The translation can be done by interpreters, that convert software instructions from source code to object code (a line at a time) and thus allow for on-the-spot error correction, or compilers, which convert the whole source program at once and create a program in object code that the computer can understand (called an object program) and save. The average business user will not have to interact directly with language translators. The level of sophistication of systems software depends on the size of the computer it operates and the tasks it is intended to perform. When operating systems were first developed, they could support only single users; many mainframe operating systems and some microcomputer operating systems can now support multitasking (performing several tasks so fast that it appears they are being done at once), multiprocessing (using two or more CPUs to process two or more programs simultaneously), timesharing

(allowing several users to work at the computer at the same time using assigned time slices), and virtual storage (employing a piecemeal procedure for using secondary storage that increases the efficiency of main memory use). The example of language processors are assemblers, compilers and interpreters.

Specific kinds of system software include: loading programs, operating systems, device drivers, programming tools, compilers, assemblers, linkers, and utility software. If system software is stored on non-volatile memory such as integrated circuits, it is usually termed firmware. The most popular disk operating systems for microcomputers are MS - DOS/PC-DOS, OS/2, Apple DOS, and UNIX. Operating systems like OS/2 and UNIX can support multi-users and multitasking on microcomputers. Software is written to work with a particular type of microprocessor and is incompatible with machines that do not use that type of processor.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

mainframes, transferring data, to reside, timesharing, virtual storage, compiler, multitasking,linker, integrated circuit, piecemeal procedure, non-volatile memory

Exercise 2. Answer the questions:

1. What are the functions of system software?
2. What kind of tasks do external command instructions perform?
3. What transfers data from memory to disk and renders text onto a display device?
4. What do operating systems create?

Exercise 3. Match the left part with the right:

1. System software is any computer software that	a) help to convert a computer language to the machine level language.
2.The level of sophistication of systems software depends on	b) it is usually termed firmware.
3. If system software is stored on non-volatile memory such as integrated circuits,	c) manages and controls computer hardware so that application software can perform a task.
4. Language processors are those that	d) the size of the computer it operates and the tasks it is intended to perform.

Exercise 4. Open the brackets using the right words:

Some low-level languages, called (assembly languages/ firmware/ timesharing), were created using abbreviations to help programmers avoid the tedious and time-consuming task of writing programs in machine language.

If system software is stored on (non-volatile memory/ compiler)) such as integrated circuits, it is usually termed firmware.

The level of sophistication of system software depends on the size of (the operation system/ the computer/ hardware components) it operates and the tasks it is intended to perform.

THE SPEAKING MODULE

III. Speaking exercises:

Exercise 1. Describe **software functions, disk operating systems, external command instructions, firmware, anti-virus software** using the suggested words and expressions as in example:

software functions manages, controls, can perform a task, helps run, computer system, makes work, anti-virus software, operation systems, communication software, printer drivers **Example:** System software is any computer software which manages and controls computer hardware so that application software can perform a task. System software helps run the computer hardware and computer system. System software is software that basically makes the computer work. Examples beside operation systems are anti-virus software, communication software and printer drivers.
disk operating systems the most popular, microcomputers, MS –DOS, OS/2, Apple DOS, UNIX, support, multi-users, multitasking, microcomputers
external command instructions perform, housekeeping tasks, frequently, “desktop” management, storage management
firmware system software, stored, non-voletile, memory, integrated circuits, termed
anti-virus software computer programs, melicious, software, identify, neutralize, eliminate

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: System software helps run the computer hardware and computer system .

2. Question: _____ ?

Answer: Internal instructions must reside in main memory at all times while the computer is on.

3. Question: _____ ?

Answer: The most popular disk operating systems for microcomputers are MS - DOS/PC-DOS, OS/2, Apple DOS, and UNIX.

4. Question: _____ ?

Answer: Both high-level and assembly languages must be translated into machine language for the CPU to use them.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **multitasking, assembly, an interface, support, language processors.**

When operating systems were first developed, they could _____ only single users; many mainframe operating systems and some microcomputer operating systems can now support _____(performing several tasks so fast that it appears they are being done at once. However, both high-level and _____languages must be translated into machine language for the CPU to use them. Operating system creates _____between user and the system hardware. System Software can be classified as operating system and_____.

Exercise 2. Fill in the table with words and expressions from the text:

	Languges	Possibilities of Operating System	Tasks of System Software
Example: Some microcomputer operating systems can now		support multitasking, multiprocessing, timesharing, etc.	
Assembly languages were created			
System software performs			
Operating system creates			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«The importance of system software for computer operation»
«Trusted operating systems»
«The invention and development of operating systems»

T e x t 3

OPERATING SYSTEM

THE READING MODULE

Read the text:

The operating system and utility programs are two major categories of system software. Just as the processor is the nucleus of a computer system, the operating system is a nucleus of all software activity.

An operating system (commonly abbreviated OS and O/S) is the software component of a computer system that is responsible for the management and coordination of activities and the sharing of the limited resources of the computer. The operating system acts as a host for applications that are run on the machine. As a host, one of the purposes of an operating system is to handle the details of the operation of the hardware. This relieves application programs from having to manage these details and makes it easier to write applications. Almost all computers, including handheld computers, desktop computers, supercomputers, and even video game consoles, use an operating system of some type. Some of the oldest models may however use an embedded operating system that may be contained on a compact disk or other data storage device.

OS is the first program loaded into a memory when the computer is turned on and, in a sense, brings life to the computer hardware. Without it, you cannot use your word processing software, spreadsheet software, or any other applications.

Without an operating system, you cannot communicate with your computer. When you give the computer a command, the operating system relays the instructions to the 'brain' of the computer, called the microprocessor or CPU. You cannot speak directly to the CPU because it only understands machine language. When you are working in an application software program, such as Microsoft Word, commands that you give to the application are sent through the operating system to the CPU.

Operating systems offer a number of services to application programs and users. Applications access these services through application programming interfaces (APIs) or system calls. By invoking these interfaces, the application can request a service from the operating system, pass parameters, and receive the results of the operation. Users may also interact with the operating system with some kind a software user interface (UI) like typing commands by using command line interface (CLI) or using a graphical user interface (GUI, commonly pronounced «gooey»). For hand-held and desktop computers, the user interface is generally considered part of an operating system. On large multi-user systems like UNIX and UNIX-like systems, the user interface is generally implemented as an application program that runs outside the operating system. (Whether the user interface should be included as part of the operating system that is a point of a contention.)

Common contemporary operating systems include Microsoft Windows, Mac OS, LINUX and Solaris. Microsoft Windows has a significant majority of market share in the desktop and notebook computer markets, while servers generally run on LINUX or other UNIX-like systems.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

nucleus, handheld computers, video game consoles, embedded operating system, relay the instruction, invoke interfaces, system calls, command line interface, graphical user interface

Exercise 2. Answer the questions:

1. What is an operating system?
2. What happens when you give your computer a command?
3. What interfaces do you know?
4. What is the difference between interface implementation on large multi-user systems and hand-held or desktop computers?

Exercise 3. Match the left part with the right:

1. As a host, one of the purposes of an operating system is to handle	a) a computer system that is responsible for the management and coordination of activities and the sharing of the limited resources of the computer.
2. By invoking these interfaces, the application can	b) a memory when the computer is turned on.
3. OS is the first program loaded into	c) the details of the operation of the hardware.
4. An operating system is the software component of	d) request a service from the operating system, pass parameters, and receive the results of the operation.

Exercise 4. Open the brackets using the right words:

Some of the oldest models may however use (an embedded operating system/ a command line interface) that may be contained on a compact disk or other data storage device.

On large multi-user systems like UNIX and UNIX-like systems, the user interface is generally implemented as (an application program/ a software component) that runs outside the operating system.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **operating system, notebook, storage device, command line interface** using the suggested words and expressions as in example:

operating system
software component, computer system, management, is responsible for, coordination of activities, sharing, limited resources **Example:** An operating system (commonly abbreviated OS and O/S) is the software component of a computer system that is responsible for the management and coordination of activities and the sharing of the limited resources of the computer.
notebook
extremely lightweight, portable, personal computer, battery pack, less than 6 pounds, on-bulky display, flat, plug in

storage device
provide, data, permanent storage, programs, floppy, hard disk, optical disks, flash memory

command line interface
interact, operating system, software, UI, typing, commands, command line, interface

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: Almost all computers, including handheld computers, desktop computers, supercomputers, and even video game consoles, use an operating system of some type.

2. Question: _____ ?

Answer: Operating systems offer a number of services to application programs and users.

3. Question: _____ ?

Answer: OS is the first program loaded into a memory when the computer is turned on.

4. Question: _____ ?

Answer: Yes, it is. The operating system is a nucleus of all software activity. .

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **operating system, application, machine language, system calls, microprocessor.**

Without an_____, you cannot communicate with your computer. When you give the computer a command, the operating system relays the instructions to the 'brain' of the computer, called the _____or CPU. You cannot speak directly to the CPU because it only understands_____When you are working in an application software program, such as Microsoft Word, commands that you give the _____are sent through the operating system to the CPU. Applications access these services through application programming interfaces (APIs) or_____ .

Exercise 2. Fill in the table with words and expressions from the text:

	User Interface	Software Component	Fuctions of Operating System
Example: An operating system is		the software component of a computer system	
Without an operating system you cannot			
On large multi-user system like UNIX			
Operating system offer a number of services			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«What do we need the operating system for?»
«What is the difference between CLI and GUI?»
«A desktop and a laptop-advantages and disadvantages».

T e x t 4

COMMON OPERATING SYSTEMS. MS-DOS and WINDOWS

THE READING MODULE

Read the text:

Common operating systems include:

MS-DOS

MS-DOS (short for Microsoft Disk Operating System) is an operating system commercialized by Microsoft. It was most commonly used member of the DOS family of operating systems and was the main operating system for computers during the 1980s. It was based on the Intel 8086 family of microprocessors, particularly the IBM PC and compatibles. It is the standard OS for all IBM PC compatibles or clones. In this text-based operating system you communicate with the computer by typing commands that exist within its library.

WINDOWS

Microsoft Windows is a series of software operating systems and graphical user interfaces produced by Microsoft. Microsoft Windows came to dominate the world's personal computer market, overtaking Mac OS.

Windows 95 is a bootable operating system in its own right. It has a graphical interface with many Macintosh-like features. It supports multimedia applications and comes with Internet software.

The Program manager is called Windows Explorer, Buttons and scroll-bars have an attractive, three dimensional look.

With Windows 98 Internet access becomes a part of the user interface. The system includes Outlook Express for E-mail, NetMeeting conferencing software, a chat program and a Web-page editor. It offers support for such technologies as DVD. It also enables to watch TV on your PC.

WINDOWS 2000

As part of its «professional» line, Microsoft released Windows 2000 in February 2000.

Windows 2000 (also referred to as Win2K) is a preemptive, interruptible, graphical and business-oriented operating system designed to work with either uniprocessor or symmetric multi-processor computers. There were released four editions of Windows 2000: Professional, Server, Advanced Server, and Datacenter Server. While each edition of Windows 2000 was targeted to a different market, they share a core set of features, including many system utilities such as the Microsoft Management Console and standard system administration applications. In October 2001, Microsoft released Windows XP, a version that also retained the consumer-oriented usability of Windows 95 and its successors. This new version was widely praised in computer magazines. Windows XP is a family of 32-bit and 64-bit operating systems produced by Microsoft

for use on personal computers, including home and business desktops, laptops, and media centers. The name «XP» stands for eXPerience. Windows XP is the successor to both Windows 2000 Professional and Windows Me, and is the first consumer-oriented operating system produced by Microsoft to be built on the Windows NT kernel (version 5.1) and architecture. The most common editions of the operating system are Windows XP Home Edition, which is targeted at home users, and Windows XP Professional, which offers additional features such as support for Windows Server domains and two physical processors, and is targeted at power users, business and enterprise clients. Windows XP is known for its improved stability and efficiency over the 9x versions of Microsoft Windows. It presents a significantly redesigned graphical user interface, a change Microsoft promoted as more user-friendly than previous versions of Windows. As of the end of September 2008, Windows XP was most widely used operating system in the world with a 69 % market share, having peaked at 85 % in December 2006 Windows XP has been criticized for its susceptibility to malware, viruses, Trojan horses and worms.

I.Reading exercises:

Exercise1. Read and memorize using the dictionary:

commercialized by, clone, compatibles, graphical user interfaces, multimedia applications, scroll-bar, three dimensional, Web-page editor, uniprocessor, multi-processor, kernel, user-friendly, susceptibility

Exercise 2. Answer the questions:

1. What does MS-DOS stand for?
2. What kind of interface was used in MS-DOS-command line interface or GUI?
3. What were the main features of Windows 95?
4. What were the new features of Windows 98?

Exercise 3. Match the left part with the right:

1. In this text-based operating system you communicate	a) its susceptibility to malware, viruses.
2. Windows XP has been criticized for	b) with many Macintosh-like features.
3. It has a graphical interface	c) with either uniprocessor or symmetric multi-processor computers.
4. Windows 2000 is a graphical and business-oriented operating system designed to work	d) by typing commands that exist within its library.

Exercise 4. Open the brackets using the right words:

Windows XP is the successor to both Windows 2000 Professional and Windows Me, and is the first consumer-oriented (operating system/ application/ uniprocessor) produced by Microsoft to be built on the Windows NT kernel and architecture.

Windows XP Professional offers additional features such as support for Windows Server (domains/ providers/ applications) and two physical processors.

THE SPEAKING MODULE

I. Speaking exercises:

Exercise 1. Describe **MS-DOS, advantages of Windows XP, operating system, scroll bar, chat program** using the suggested words and expressions as in example:

MS-DOS
an operating system, commercialized, most commonly used, based on, family of microprocessors, compatibles, the standard OS, text-based, communicate, typing commands

Example: Library MS-DOS (short for Microsoft Disk Operating System) is an operating system commercialized by Microsoft. It was most commonly used member of the DOS family of operating systems and was the main operating system for computers during the 1980s. It was based on the Intel 8086 family of microprocessors, particularly the IBM PC and compatibles. It is the standard OS for all IBM PC compatibles or clones. In this text-based operating system you communicate with the computer by typing commands that exist within its library.

advantages of Windows XP
is known for, improved, stability, efficiency, presents, redesigned, graphical user interface, user-friendly, previous versions, the most widely used, operating system

operating system
programs, routines, allow computer, to operate, coordinate, hardware, software, computer system

scroll bar
move, document, window, text, another part, becomes, visible

chat program
real - time, conversation, interactive, Internet

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: In DOS you communicate with computer by typing commands that exist within its library.

2. Question: _____ ?

Answer: The Program manager in Windows 95 was called Windows Explorer.

3. Question: _____ ?

Answer: Windows XP is the successor to both Windows 2000 Professional.

4. Question: _____ ?

Answer: Yes, it is. Windows XP is most widely used operating system in the world.

THE WRITING MODULE

II. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **scroll-bars, editor, data center, stability, malware.**

Buttons and _____have an attractive, three dimensional look. The system includes Outlook Express for E-mail, NetMeeting conferencing software, a chat program and a Web-page _____ Windows XP is known for its improved _____and efficiency over the 9x versions of Microsoft Windows. Windows XP has been criticized for its susceptibility to_____, viruses. There were released four editions of Windows 2000: Professional, Server, Advanced Server, and _____Server.

Exercise 2. Fill in the table with the words and expressions from the text:

	Windows 95 Software	Windows 2000 Editions	Widows XP Advantages
Example: The system includes	Outlook Express for E-mail, NetMeeting conferencing software, a chat program and a Web-page editor		
There were released four editions of Widows 2000			
Windows XP is known for its improved			
Windows 95 supports multimedia applications			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«What Windows version have you installed on your computer and why?»
«The development of Windows versions»
«What OS is the most popular in the world and in our country?»

T e x t 5

COMMON OPERATING SYSTEMS. MACINTOSH, OS/2 Warp, UNIX, LINUX, OPEN VMS)

THE READING MODULE

Read the text:

MACINTOSH (APPLE)

Macintosh, commonly nicknamed Mac, is a brand name which covers several lines of personal computers designed, developed, and marketed by Apple Inc. It was the first commercially successful personal computer to feature a mouse and a graphical user interface (GUI) rather than a command line interface. Most of the Mac OS code is in the ROM chips. These contain hundreds of routines (sequence of instructions) which perform such tasks as starting up the computer, transferring data from disks to peripherals and controlling the RAM space. The system file is loaded automatically at start-up, and contains information that modifies the routines of the OS in the ROM chips. The Finder displays the Macintosh desktop and enables a user to work with disks, programs and files. It allows multitasking. It has an Internet set-up assistant, an e-mail program and a Web browser.

OS/2 Warp (IBM)

This is most technically sophisticated operating system. It provides true multitasking, allowing a program to be divided into «thread», many of which can be run at the same time. The IBM OS/2 Warp includes easy access to networks via modem, support for java applications and a voice recognition technology.

UNIX

The operating system designed by Bell laboratories in the USA for minicomputers, has been widely adopted for many corporate installations.From the very first, it was designed to be a multitasking system. It is written in C language.

It has become an operating environment for software development, available for any type of machine from IBM to Macs to Cray supercomputers. UNIX is the most commonly used system for advance CAD programs.

LINUX

LINUX is used as a highly value, fully-functional UNIX – workstation for applications ranging from Internet servers to reliable work group computing. LINUX is available for Intel, Alfa and Sun SPARC platforms.

OPEN VMS

The Open VMS operating system is Digital's popular general purpose OS for all VAX computers. It provides data and access security. Open VMS supports all types of Digital and multivendor networks.

JAVA OS

This is designed to execute Java programs on Web-based PCs. It is written in Java, a programming language that allows Web pages to display animation, play music, etc. The central component of Java OS is known as Java Virtual Machine.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

command line interface, RAM space, is loaded automatically, Finder, Web browser, access to, voice recognition, workstation, multivendor networks

Exercise 2. Answer the questions:

1. What is the name of a brand that covers several lines of personal computers designed, developed, and marketed by Apple Inc.?
2. What kind of interface did Macintosh use?
3. What OS allows a program to be divided into «threads», many of which can be run at the same time?
4. What language was used to write UNIX?

Exercise 3. Match the left part with the right:

1. CAD	a) modulator-demodulator
2. IBM	b) hard disc drive
3. HDD	c) computer aided design
4. modem	d) International Business machines

Exercise 4. Open the brackets using the right words:

It (was/ were/ did) the first commercially successful personal computer to feature a mouse and a graphical user interface (GUI) rather than a command line interface.

It (is provided/ provides/ providing) data and access security.

Open VMS (is supporting/ supports/ is supported) all types of Digital and multivendor networks.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **mouse, Macintosh, routines, Macintosh Finder, browser** using the suggested words and expressions as in example:

mouse input, device, with the ball, specify, rolled by the user, position, cursor, choose, menu, item **Example:**A mouse is an input device with the ball rolled by the user to specify the position of the cursor or choose the menu item.
Macintosh nickname, brand name, personal computer, designed, developed, Apple Inc., commercially successful, a mouse, a graphical user interface, a command line interface
routines sequence, instruction, perform, task, starting up, tranferring, disk, data, peripherals, controlling, RAM, space
Macintosh Finder desplay, desktop, enable, user, disk, program, file
browser program, fetch, designed, desplay, Web page, on the Internet

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: It is a brand name which covers several lines of personal computers designed, developed, and marketed by Apple Inc.
2. Question: _____ ?
Answer: The Finder displays the Macintosh desktop.
3. Question: _____ ?
Answer: Yes, it does. Warp includes easy access to networks via modem.
4. Question: _____ ?
Answer: The central component of Java OS is Java Virtual Machine.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **Multitasking, Virtual Machine, multivendor, RAM.**

These contain hundreds of routines (sequence of instructions) which perform such tasks as starting up the computer, controlling the ____space. It provides true_____, allowing the program to be divided into «threads», many of which can be run at the same time. Open VMS supports all types of Digital and_____ networks. The central component of Java OS is known as Java_____.

Exercise 2. Fill in the table with the words and expressions from the text:

	Multitasking Systems	Types of ROM Chips Instructions	Programming lLanguage
Example: These contain hundreds of routines which perform	Outlook Express for E-mail, NetMeeting conferencing software, a chat program and a Web-page editor	such tasks as starting up the computer, transferring data from discs to peripherals and controlling the RAM space.	
From the very first UNIX was designed			
LUNUX is used as			
It is written in Java			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«What do you know about Macintosh company?»

«LINUX embedded devices-smart phones, mobile phones, digital video recorder etc.»

«Richard Stallman and Linus Torvalds, creators of LINUX»

T e x t 6

SYSTEM UTILITIES PROGRAMS

THE READING MODULE

Read the text:

Utility programs help manage, maintain and control computer resources. These programs are available to help you with the day-to-day chores associated with personal computing and to keep your system running at peak performance. Some examples of utility programs include:

Disk defragmenters.

Examples include a disk defragmenter that can detect computer files whose contents have been not Italic text stored on the hard disk in disjointed fragments, and move the fragments together to increase efficiency; a disk checker can scan the contents of a hard disk to find files or areas that are corrupted in some way, or were not correctly saved, and eliminate them for a more efficiently operating hard drive; a disk cleaner can find files that unnecessary to computer operation, or take up considerable amounts of space. Disk cleaner helps the user to decide what to delete when their hard disk is full.

System profilers.

A system profiler can provide detailed information about the installed software and hardware attached to the computer. Backup software can make a copy of all information stored on a computer, and restore either the entire system (e.g. in an event of disk failure) or selected files (e.g. in an event of accidental deletion). Disk compression software can transparently compress the contents of the hard disk, in order to fit more information to the drive.

Virus scanners.

Virus Scanning Software are utility programs designed to protect your computer from computer viruses. This kind of software is critical to uses, due to the number of computer viruses (small computer programs created to disrupt and destroy computer files and/or operating system software).Virus scanning software needs to be updated on a regular basis (usually monthly). Updates insure that your virus scanning software will protect you from the most recent viruses.

Binary/text editor utility directly modifies a text or data of a file without the WYSIWYG view in editor suites. These files could be data or an actual program.

Archive utilities output a stream or a single file when provided with a directory or a set of files. Compression utilities output a shorter stream or a smaller file when provided with a stream or file.

Encryption utilities use a specific algorithm to produce an encrypted stream or encrypted file when provided with a key and a plaintext.

Application launchers provide a convenient access point for application software.

Registry cleaners clean and optimize the windows registry by removing old registry keys that are no longer in use.

Network managers - programs that check your network, log events and check data transfer.

System Utilities - utility programs that provide a convenient method of performing routine data management tasks, such as deleting, renaming, cataloging, uncataloging, moving, copying, merging, generating and modifying data sets, particularly used on mainframe computers such as IBM mainframe utility programs.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

utility programs, running at peak performance, disk defragmenters, scan the contents, compression software, backup, directory, WYSIWYG, algorithm, encrypted file, merging, modifying

Exercise 2. Answer the questions:

1. What are the utility programs used for?
2. What kind of utility programs do you know?
3. What is a disk defragmenter?
4. What software can make a copy of all information stored in the computer?

Exercise 3. Match the left part with the right:

1. These programs are available to help you with the day-to-day chores	a) protect you from the most recent viruses.
2. Updates insure that your virus scanning software will	b) the number of computer viruses.
3. Registry cleaners clean and optimize the windows registry by removing	c) associated with personal computing and to keep your system running at peak performance.
4. This kind of software is critical to uses, due to	d) old registry keys that are no longer in use.

Exercise 4. Open the brackets using the right words:

Examples include a disk defragmenter that can (detect/ delete/ activate) computer files whose contents have been not Italic text stored on the (hard disk/ CD discs/

mainframes) in disjointed fragments, and move the fragments together to (increase/ eliminate/ decrease) efficiency.

Encryption utilities use a specific (binary digit/ algorithm/ circuit) to produce an encrypted stream.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **utility program, disk checker, virus scanners, system utilities, registry cleaners** using the suggested words and expressions as in example:

utility program manage, maintain, control, computer resources, day-to-day chores, associated, personal computing, keep your system running, at peak performance **Example:**Utility programs help manage, maintain and control computer resources. These programs are available to help you with the day-to-day chores associated with personal computing and to keep your system running at peak performance
disk checker scan, contens, hard disk, find file, corrupted, not correctly saved, eliminate, efficiently, operating, hard drive
virus scanner utility program, protect, designed, computer viruses
system utilities provide, perform, convenient method, routine data management task, deleting, renaming, cataloging, moving, copying, merging, generating, modifying data sets
registry cleaner clean, optimize, registry, removing, no loger in use, old registry key

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: A system profiler can provide detailed information about the software installed and hardware attached to the computer.

2. Question: _____ ?

Answer: Application launchers provide a convenient access point for application software

3.Question:_____?

Answer: Network managers - programs that check your network, log events and check data transfer.

4.Question:_____?

Answer: Disk cleaner helps the user to decide what to delete when their hard disk is full.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **compression software, backup, profiler.**

Utility programs help manage, maintain and control_____. A system _____can provide detailed information about the software installed and hardware attached to the computer_____ software can make a copy of all information stored on a computer, and restore either the entire system or selected files. Disk _____can transparently compress the contents of the hard disk, in order to fit more information to the drive.

Exercise 2. Fill in the table with words and expressions from the text:

Exercise 3. Compose a story on one of the topics (up to 100 words):

	System Utilities	Virus Scanning Software	Utilities Programs Examples
Example: A disc cleaner can find			files that unnecessary to computer operation
A system profiler can provide			
This kind of software is critical to uses,			
They provide a covenient method of performing			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«What kind of utility software do you know?»
«What kind of utility software do you consider to be the most important?»
«Antivirus programs»

T e x t 7

WHAT IS A USER INTERFACE?

THE READING MODULE

Read the text:

A user interface is the junction between a user and a computer program. An interface is a set of commands or menus through which a user communicates with a program. It is how you interact with the computer. The term «user interface» refers to the standard procedures a user follows to interact with a particular computer. There are two common user interfaces:

A command-driven interface is one in which you type in commands to make the computer do something. You have to know the commands and what they do and they have to be typed correctly. DOS and UNIX are examples of command-driven interfaces.

In fact only the experts used the computers so there was no need for a user friendly interface.

A graphical user interface (GUI) is one in which you select command choices from various menus, buttons and icons using a mouse. It is a user-friendly interface. Macintosh computers with a user interface based on graphics and intuitive tools were designed with a single clear aim: to facilitate interaction with the computer. Their interface is called WIMP (Window, Icon, Mouse, Pointer) and software products for the Macintosh have been designed to take full advantage of its features using the interface. In 1984, the Apple Company introduced the first GUI computer, Macintosh. Windows 95/98, NT, ME, 2000 and XP are all GUI operating systems. Today the most innovative GUIs are the Macintosh, Microsoft Windows and IBM OS\2 Warp. These three platforms include similar features: a desktop with icons, windows and folders, a printer selector, a file finder, a control panel, various disc accessories. The three platforms differ in other areas such as device installation, network connectivity or compatibility with application programs. These interfaces have been so successful because they are extremely easy to use. It is well known that computers running under an attractive interface simulate users to be more creative and produce high quality results, which have a major impact on the general public.

Text user interfaces (TUI) share with GUIs their use of the entire screen area and exposure of available commands through widgets like form entry and menus. However, TUIs only use text and symbols available on a typical text terminal, while GUIs typically use high resolution graphics modes. This allows GUI to present more detailed information and fine-grained direct manipulation.

Zooming user interface or zoomable user interface (ZUI, pronounced zoo-ee) is a graphical environment where users can change the scale of the viewed area in order to see more detail or less. A ZUI is a type of graphical user interface (GUI). Information

elements appear directly on an infinite virtual desktop (usually created using vector graphics), instead of in windows. Users can pan across the virtual surface in two dimensions and zoom into objects of interest. For example, as you zoom into a text object it may be represented as a small dot, then a thumbnail of a page of text, then a full-sized page and finally a magnified view of the page. Some experts consider the ZUI interface paradigm as a flexible and realistic successor to the traditional windowing GUI. But little effort is currently spent developing ZUIs, while there are ongoing efforts for developing GUIs.

I. Reading exercises:

Exercise 1. Read and memorize using the dictionary:

junction, intuitive tools, folder, printer selector, file finder, control panel, various disc accessories, text user interfaces, screen area, widgets, high resolution graphics, fine-grained

Exercise 2. Answer the questions:
1. What is a command-driven interface?
2. What do we call the Macintosh interface?
3. What are the similar features of Macintosh, Microsoft Windows and IBM OS/2 Warp?
4. How do these three platforms differ?

Exercise 3. Match the left part with the right:

1.TUI share with GUIs their use of the entire screen area and exposure of available commands through	a) a flexible and realistic successor to the traditional windowing GUI.
2.The three platforms differ in other areas such as	b) various menus, buttons and icons using a mouse.
3.Some experts consider the ZUI interface paradigm as	c) device installation, network connectivity or compatibility with application programs.
4.A graphical user interface is one in which you select command choices from	d) widgets like form entry and menus.

Exercise 4. Open the brackets using the right words:

A graphical user interface (GUI) is the one in which you select (command choices/menu options) from various menus, buttons and icons using a mouse.

Information elements appear directly (on an infinite virtual desktop/as series of sound signals), instead of in windows.

THE SPEAKING MODULE

I. Speaking exercises:

Exercise 1. Describe **interface, user-friendly interface, text user interfaces, zooming user interface, command-driven interface** using the suggested words and expressions as in example:

interface junction, user, computer program, a set of commands, menus, communicates, interact, computer, refers, standard procedures, follow **Example:**The user interface is the junction between a user and a computer program. An interface is a set of commands or menus through which a user communicates with a program. It is how you interact with the computer. The term «user interface» refers to the standard procedures the user follows to interact with a particular computer.
user-friendly interface graphical, user interface, select, command choices, various menus, buttons, icons, mouse

user-friendly interface graphical, user interface, select, command choice, various menu, button, icon, mouse
text user interface use, entire, screen area, exposure, available command, widget, menu, text and symbol, a typical text terminal
zooming user interface graphical environment, change, scale, viewed area, more detail, information element, appear, directly, infinite virtual, desktop, instead of in windows, pan across, virtual surface, in two dimensions, zoom, objects of interest
command-driven interface type in, command, make, computer, do something, know the command, correctly

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: There are two common user interfaces.

2. Question: _____ ?

Answer: On an infinite virtual desktop.

3. Question: _____ ?

Answer: These three platforms differ in other areas such as device installation, network connectivity or compatibility with application programs.

4. Question: _____?

Answer: Zooming user interface or zoomable user interface (ZUI, pronounced zoo-ee) is a graphical environment where users can change the scale of the viewed area in order to see more detail or less.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **command-driven, text terminal, network connectivity, various menus.**

A _____interface is one in which you type in commands to make the computer do something. A graphical user interface (GUI) is one in which you select command choices from_____, buttons and icons using a mouse. The three platforms differ in other areas such as device installation, _____or compatibility with application programs. However, TUIs only use text and symbols available on a typical_____.

Exercise 2. Fill in the table with words and expressions from the text:

	Platform Features	Types of Interface	ZUI Functions
Example: A command-driven interface is one in which		You type in commands to make the computer do something	
A graphical user interface is one in which you			
Those three platforms include			
ZUI is a graphical environment where			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«What is Word processing?»
«What kind of interfaces do you know and how do they differ?»
«A graphical user interface»

T e x t 8

DEVICE DRIVERS AND INTERRUPTS

THE READING MODULE

Read the text:

A device driver is a specific type of computer software developed to allow interaction with hardware devices. Typically this constitutes an interface for communicating with the device, through the specific computer bus or communications subsystem that the hardware is connected to, providing commands to/or receiving data from the device, and on the other end, the requisite interfaces to the operating system and software applications. It is a specialized hardware-dependent computer program which is also a specific operating system that enables another program, typically an operating system or application software package or a computer program running under the operating system kernel, to interact transparently with a hardware device, and usually provides the requisite interrupt handling necessary for any necessary asynchronous time-dependent hardware interfacing needs.

The key design goal of device drivers is abstraction. Every model of hardware (even within the same class of device) is different. Newer models also are released by manufacturers that provide more reliable or better performance and these newer models are often controlled differently. Computers and their operating systems cannot be expected to know how to control every device, both now and in the future. To solve this problem, OSes essentially dictate how every type of device should be controlled. The function of the device driver is then to translate these OS mandated function calls into device specific calls. In theory a new device, which is controlled in a new manner, should function correctly if a suitable driver is available. This new driver will ensure that the device appears to operate as usual from the operating systems' point of view for any person.

Interrupts

Interrupts are central to operating systems as they allow the operating system to deal with the unexpected activities of running programs and the world outside the computer. Interrupt-based programming is one of the most basic forms of time-sharing, being directly supported by most CPUs. Interrupts provide a computer with a way of automatically running specific code in response to events. Even very basic computers support hardware interrupts, and allow the programmer to specify code which may be run when that event takes place.

When an interrupt is received, the computer's hardware automatically suspends whatever program is currently running by pushing the current state on a stack, and its registers and program counter are also saved. This is analogous to placing a bookmark in a book when someone is interrupted by a phone call. This task requires no operating system as such, but only that the interrupt be configured at an earlier time.

In modern operating systems, interrupts are handled by the kernel of the operating system. Interrupts may come from either the computer's hardware, or from the running program. When a hardware device triggers an interrupt, the kernel of the operating system decides how to deal with this event, generally by running some processing code, or ignoring it. The processing of hardware interrupts is a task that is usually delegated to software called device drivers, which may be either part of the kernel of the operating system, part of another program, or both. Device drivers may then relay information to a running program by various means.

A program may also trigger an interrupt to the operating system, which is very similar in function. If a program wishes to access hardware for example, it may interrupt the kernel of the operating system, which causes control to be passed back to the kernel. The kernel may then process the request which may contain instructions to be passed onto hardware, or to a device driver. When a program wishes to allocate more memory, launch or communicate with another program, or signal that it no longer needs the CPU, it does so through interrupts.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

device driver, computer bus, communications subsystem, hardware-dependent, specific code, system kernel, interrupt, trigger, running program, asynchronous

Exercise 2. Answer the questions:

1. What is a structure of a device driver?
2. What is a function of a device driver in interaction of OS and new devices?
3. What is an interrupt?
4. How are interrupts handled in modern operating systems?

Exercise 3. Match the left part with the right:

1. A device driver is a specific type of computer software developed to	a) handled by the operating system's kernel.
2. Interrupts allow the operating system to deal with the unexpected	b) computer software developed to allow interaction with hardware devices.
3. In modern operating systems, interrupts are	c) allow interaction with hardware devices.
4. A device driver is a specific type of	d) activities of running programs and the world outside the computer.

Exercise 4. Open the brackets using the right words:

When a hardware device triggers an interrupt, (the kernel of the operating system / the main memory) decides how to deal with this event, generally by running some processing code, or ignoring it.

The kernel then processes the request which may contain (instructions/ warning, prohibition) to be passed onto hardware, or to a device driver.

A device driver is a specific type of computer software developed (to allow/ stop/ prevent) interaction with hardware devices.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **interrupts, device driver, functions of the device driver, kernel** using the suggested words and expressions as in example:

interrupts specific code, running programs, provide, operating systems, the unexpected activities, allow, to deal with, automatically running, in response to events **Example:** Interrupts are central to operating systems as they allow the operating system to deal with the unexpected activities of running programs and the world outside the computer. Interrupts provide a computer with a way of automatically running specific code in response to events.
device driver specific type, interaction, constitute, communications subsystem, connect to, providing command, hardware-dependent, running, the operating system, kernel, interact transparently, the requisite, interrupt asynchronous, time-dependent
function of the device driver translate, OS mandated, function, specific calls, ensure, appears, operate
kernel process, request, contain, instructions, passed, hardware, a device driver

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: A device driver is a specific type of computer software developed to allow interaction with hardware devices.

2. Question: _____ ?

Answer: They allow the operating system to deal with the unexpected activities of running programs and the world outside the computer.

3. Question: _____ ?

Answer: Interrupt-based programming is one of the most basic forms of time-sharing.

4. Question: _____ ?

Answer: The key design goal of device drivers is abstraction.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **kernel of the operating system, device drivers, interrupts, relay information, running program.**

In modern operating systems,_____are handled by the kernel of the operating system. Interrupts may come from either the computer's hardware, or from the_____. When a hardware device triggers an interrupt, the _____decides how to deal with this event. The processing of hardware interrupts is a task that is usually delegated to software called_____, which may be either part of the kernel of the operating system, part of another program, or both. Device drivers may then _____to a running program by various means

Exercise 2. Fill in the table with words and expressions from the text:

	Interrupts Tasks	Programming	Device Driver Functions
Example: Interrupts provide a computer with	A way of automatically running specific code in response to events		
The processing of hardware interrupts is			
Interrupt-based programming			
Typically this constitutes an interface			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«The evolution of operating system»
«How to choose the right operating system?»
«Device drivers»

T e x t 9

THE SYSTEM KERNEL

THE READING MODULE

Read the text:

«Kernel» is the part of an operating system that provides the most basic services to application software running on a processor. The «kernel» of a real-time operating system («RTOS») provides an «abstraction layer» that hides from application software the hardware details of the processor (or set of processors) upon which the application software will run.

In providing this «abstraction layer» the RTOS kernel supplies five main categories of basic services to application software. The most basic category of kernel services is Task Management. This set of services allows application software developers to design their software as a number of separate «chunks» of software - each handling a distinct topic, a distinct goal, and perhaps its own real-time deadline. Each separate «chunk» of software is called a «task». Services in this category include the ability to launch tasks and assign priorities to them. The main RTOS service in this category is the scheduling of tasks as the embedded system is in operation. The Task Scheduler controls the execution of application software tasks, and can make them run in a very timely and responsive fashion.

The second category of kernel services is Intertask Communication and Synchronization. These services make it possible for tasks to pass information from one to another, without danger of that information ever being damaged. They also make it possible for tasks to coordinate, so that they can productively cooperate with one another. Without a help of these RTOS services, tasks might well communicate corrupted information or otherwise interfere with each other.

Many (but not all) RTOS kernels provide Dynamic Memory Allocation services. This category of services allows tasks to «borrow» chunks of RAM memory for temporary use in application software. Often these chunks of memory are then passed from task to task, as means of quickly communicating large amounts of data between tasks. Some very small RTOS kernels that are intended for tightly memory-limited environments, do not offer Dynamic Memory Allocation services.

Many (but not all) RTOS kernels also provide a «Device I/O Supervisor» category of services. These services, if available, provide a uniform framework for organizing and accessing many hardware device drivers that are typical of an embedded system.

In addition to kernel services, many RTOSs offer a number of optional add-on operating system components for such high-level services as file system organization, network communication, network management, database management, user-interface graphics, etc. Although many of these add-on components are much larger and much more complex than the RTOS kernel, they rely on the presence of the RTOS kernel and

take advantage of its basic services. Each of these add-on components is included in an embedded system only if its services are needed for implementing the embedded application, in order to keep program memory consumption to minimum.

Many non-real-time operating systems also provide similar kernel services. The key difference between general-computing operating systems and real-time operating systems is the need for «deterministic» timing behavior in the real-time operating systems. Formally, «deterministic» timing means that operating system services consume only known and expected amounts of time. In theory, these service times could be expressed as mathematical formulas. These formulas must be strictly algebraic and not include any random timing components. Random elements in service times could cause random delays in application software and could then make the application randomly miss real-time deadlines – a scenario clearly unacceptable for a real-time embedded system.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

real-time operating system, abstraction layer, real-time deadline, I/O, framework, embedded system, database management, consume, random timing, delays

Exercise 2. Answer the questions:

1. What is a kernel?
2 What do we call «the most basic category of kernel services»?
3 What does the Task Scheduler control?
4 What is the key difference between general-computing operating systems and real-time operating systems?

Exercise 3. Match the left part with the right:

1. In providing this «abstraction layer» the RTOS kernel supplies	a) operating system services consume only known and expected amounts of time.
2. The second category of kernel services is	b) five main categories of basic services to application software.
3. Formally, «deterministic» timing means that	c) any random timing components.
4. These formulas must be strictly algebraic and not include	d) Intertask Communication and Synchronization.

Exercise 4. Open the brackets using the right words:

In addition to (real-time deadline/kernel services), many RTOSs offer a number of optional add-on operating system components for such high-level services.

These services make it possible for tasks to (encode/pass) information from one to another, without danger of that information ever being damaged.

THE SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **Task Scheduler, kernel, abstraction layer, Intertask Communication and Synchronization, random element** using the suggested words and expressions as in example:

Task Scheduler software tasks, responsive, controls, the execution, application, make them run, timely, fashion. **Example:**The Task Scheduler controls the execution of application software tasks, and can make them run in a very timely and responsive fashion.
kernel provide, basic, servises, application, sofware, running on a processor, " abstraction layer", hides, hardware, details of the processor, will run
abstraction layer hides, application software, harware details, processor, set of processors, will run
Intertask Communication and Synchronization tasks, pass information, danger, from one to another, coordinate, productively, cooperate might, corrupted information, interfere
random element could cause, random delays, application software, randomly, miss, real-time deadlines, a scenario, clearly unacceptable, a real-time embedded system

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?

Answer: The «kernel» of a real-time operating system provides «abstraction layer» that hides from application software the hardware details of the processor (or set of processors) upon which the application software will run.

2. Question: _____?

Answer: The RTOS kernel supplies five main categories of basic services to application software.

3. Question: _____ ?

Answer: Random elements in service times could cause random delays in application software and could then make the application randomly miss real-time deadlines.

4. Question: _____ ?

Answer: The key difference between general-computing operating systems and real-time operating systems is the need for «deterministic» timing behavior in the real-time operating systems.

THE WRITING MODULE

III. Writing exercises:

Exercise 1. Complete the sentences with the suggested words: **random delays, formulas, embedded system, damaged, random timing.**

These services make it possible for tasks to pass information from one to another, without danger of that information ever being_____.In theory, these service times could be expressed as mathematical_____. These formulas must be strictly algebraic and not include any _____components. Random elements in service times could cause _____in application software. The main RTOS service in this category is the scheduling of tasks as the _____is in operation.

Exercise 2. Fill in the table with words and expressions from the text:

	Categories of Kernel	Kernel Functions	Operating System Components
Example: Kernel provides an "abstraction layer"		That hides from application software the hardware details of the processor	
Task Management allows			
These services make it possible for tasks			
Each of these add-on components			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«History of kernel development»
«Categories of kernel »
«What additional information can you give about the kernels?»

T e x t 10

SOFTWARE ENGINEERING

THE READING MODULE

Read the text:

Systems programming (or system programming) is the activity of programming system software. The primary distinguishing characteristic of systems programming when compared to application programming is that application programming aims to produce software which provides services to the user (e.g. word processor), whereas systems programming aims to produce software which provides services to the computer hardware (e.g. disk defragmenter). It also requires a greater degree of hardware awareness.

A software system consists of executable computer code and the supporting documents needed to manufacture, use and maintain the code. For example, a word processing system consists of an executable program (the word processor), user manuals and the documents, such as requirements and designs, needed to produce the executable program and manuals.

Software engineering is ever more important as larger, more complex and life-critical software systems proliferate. The rapid decline in the costs of computer hardware means that the software in a typical system often costs more than the hardware it runs on. Large software systems may be the most complex things ever built. This places great demands on the software engineering process that must be disciplined and controlled.

The software engineering process itself is usually divided into phases. The definition of these phases, their ordering and the interactions between the phases specify a software life-cycle model. The best-known life-cycle model is the waterfall model consisting of a requirements definition phase, a design phase, a coding phase, a testing phase and a maintenance phase. The output of each phase serves as the input to the next.

The purpose of the requirements phase is to define what a system should do and the constraints under which it must operate. This information is recorded in a requirements document. A typical requirements document might include a product overview; a specification of the development, operating, and maintenance environment for the product; a high-level conceptual model of the system; a specification of the user interface; specification of functional requirements; specification of nonfunctional requirements; specification of interfaces to systems outside the system under development; specification of how errors will be handled; and a listing of possible changes and enhancements to the system. Each requirement, usually numbered for reference, must be testable.

In the design phase, a plan is developed for how the system will implement the requirements. The plan is expressed using a design method and notation. Many methods and notations for software design have been developed. Each method focuses on certain aspects of a system and ignores or minimizes others. This is similar to viewing a

building with an architectural drawing, a plumbing diagram, an electrical wiring diagram, and so forth.

The coding phase of the software life-cycle is concerned with the development of code that will implement the design. This code is written in a formal language called a programming language. Programming languages have evolved over time from sequences of ones and zeros directly interpretable by a computer, through symbolic machine code, assembly languages, and finally to higher-level languages that are more understandable to humans.

Most coding today is done in one of the higher-level languages. When code is written in a higher-level language, it is translated into assembly code, and eventually machine code, by a compiler. Many higher-level languages have been developed, and they can be categorized as functional languages, declarative languages and imperative languages.

Following the principle of modularity, code on large systems is separated into modules, and the modules are assigned to individual programmers. A programmer typically writes the code using a text editor. Sometimes a syntax-directed editor that "knows" about a given programming language and can provide programming templates and check code is used for syntax errors. Various other tools may be used by a programmer, including a debugger that helps find errors in the code, a profiler that shows which parts of a module spend most time executing, and optimizers that make the code run faster.

I. Reading exercises:

Exercise1. Read and memorize using the dictionary:

executable computer code, phase, interaction, ordering, life-cycle model, waterfall model, maintenance, functional requirements, programming language, functional languages, compiler, modularity, debugger

Exercise 2. Answer the questions:

1. What is system programming?
2. What is the difference between application programming and system programming?
3. What does a software system consist of?
4. What phases is the software engineering process divided into?

Exercise 3. Match the left part with the right:

1. The rapid decline in the costs of computer hardware means that	a) the development of code that will implement the design.

2. The coding phase of the software life-cycle is concerned with	b) the system will implement the requirements.
3. Following the principle of modularity, code on large systems is separated into	c) the software in a typical system often costs more than the hardware it runs on.
4. In the design phase, a plan is developed for how	d) modules, and the modules are assigned to individual programmers.

Exercise 4. Open the brackets using the right words:

Following the principle of (magnetization/ polarity or modularity), code on large systems is separated into (atoms/ cells/ modules), and the modules are assigned to individual programmers.

Many (simple language systems, machine codes, higher-level languages) can be categorized as functional languages, declarative languages and imperative languages.

A software system consists of (application, phase interaction, executable computer code) and the supporting documents needed to manufacture, use and maintain the code.

SPEAKING MODULE

II. Speaking exercises:

Exercise 1. Describe **programming tools, requirements phase, compiler, coding phase, programming tools** using the suggested words and expressions as in example:

programming tools programmer, writes the code, a text editor, a syntax-directed editor, a given programming language, programming templates, check for syntax errors, a debugger, find errors in the code, a profiler, a module, optimizers, run faster **Example:** A programmer typically writes the code using a text editor. Sometimes a syntax-directed editor that «knows» about a given programming language and can provide programming templates and check code for syntax errors is used. Various other tools include a debugger that helps find errors in the code, a profiler that shows which parts of a module spend most time executing, and optimizers that make the code run faster.
requirements phase define, system, constrain, a requirements document, product overview, a specification, operating, maintenance, environment, high-level, conceptual model of the system, functional requirements, listing, enhancements
compiler

covert, written in high-level language, an object, a source program, special program
coding phase software life-cycle, code, concerned, design, development, implement, formal language, programming language
programming tool debugger, find errors, profiler, in the code, parts of a module, executing, optimozer, run facter

Exercise 2. Ask the questions to the given answers:

1. Question: _____ ?
Answer: A software system consists of executable computer code and the supporting documents.
2. Question: _____ ?
Answer: The higher-level languages can be categorized as functional languages, declarative languages, and imperative languages.
3. Question: _____ ?
Answer: Most coding today is done in one of the higher-level languages.
4. Question: _____ ?
Answer: The best-known life-cycle model is the waterfall model.

THE WRITING MODULE

III. Writing exercises:

Exercise1. Complete the sentences with the suggested words: **executable program, programming language, executable computer code, modularity, coding phase.**

A software system consists of _____ and the supporting documents needed to manufacture, use, and maintain the code. For example, a word processing system consists of an_____ (the word processor), user manuals and the documents, such as requirements and designs, needed to produce the executable program and manuals. The _____ of the software life-cycle is concerned with the development of code that will implement the design. This code is written in a formal language called a_____. Following the principle of_____, code on large systems is separated into modules and the modules are assigned to individual programmers.

Exercise 2. Fill in the table with words and expressions from the text:

	Life-Cycle Models	Software Engineering Process Phases	Software System Elements
Example: A software system sonsists of			executable computer code and the supporting documents
The best-known life-cycle model is			
In the design phase			
The coding phase of the software life-cycle is concerned with			

Exercise 3. Compose a story on one of the topics (up to 100 words):

«Systems programming as an activity of programming system software»
«History of programming»
«Phases of system programming»

K E Y S

UNIT 1

T e x t 1

I. Reading exercises:
Exercise 3
1.b; 2.c; 3.a; 4.d.
Exercise 4
include; damaged
II. Speaking exercises:
Exercise 2 (suggested questions)
1. What are the major systems of the automobile?
2. What does the power plant include?
3. What does the engine produce?
4. What do steering and braking systems provide?
III. Writing exercises:
Exercise 1
support; by; over; starts; ; as;

T e x t 2

I. Reading exercises:
Exercise 3
1.c; 2.a; 3.e; 4.b; 5.d.
Exercise 4
used; place
II. Speaking exercises:
Exercise 2 (suggested questions)
1. What does OHV mean?
2. How is OHV engine also known for?
3. What do OHS and SOHC mean?
4. What does «Double OverHead Cam engine can «breath» better» mean?
III. Writing exercises:
Exercise 1
in; by; at; to; per; cylinder; with

T e x t 3

I. Reading exercises:
Exercise 3
1.c; 2.d; 3.a; 4.b.

Exercise 4
involve; based; have

II. Speaking exercises:

Exercise 2 (suggested questions)
1. What type of spring is the most common?
2. How can a tension spring be wound?
3. What do rotary springs involve?
4. What is similar to the helical tension spring in requiring specially formed ends to transmit the load?

III. Writing exercises:

Exercise 1
is; used; are; exists; find

T e x t 4

I. Reading exercises:

Exercise 3
1.c; 2.d; 3.a; 4.b.
Exercise 4
earliest; lighter; chemistry; dissimilar; peroxide

II. Speaking exercises:

Exercise 2 (suggested questions)
1. How is battery energy used?
2. What does the chemical reaction totally destroy?
3. What are today batteries?
4. What mixture is the acid?

III. Writing exercises:

Exercise 1
which; greater; series; output; discharges

T e x t 5

I. Reading exercises:

Exercise 3
1.c; 2.a; 3.d; 4.b
Exercise 4
use; greater; arranged; initial

II. Speaking exercises:

Exercise 2 (suggested questions)
1. How are the six battery cells arranged?
2. What does the spiral wound construction also offer?
3. Are hybrid replacement batteries available in the aftermarket?
4. What does lithium-ion technology offer?

III. Writing exercises:
Exercise 1
use; allows; arranged; delivers; raises

T e x t 6

I. Reading exercises:
Exercise 3
1.c; 2.a; 3.d; 4.b.
Exercise 4
thick; recommend; cold;
II. Speaking exercises:
Exercise 2 (suggested questions)
1. When does the timing chain stretch?
2. What do the timing chain and gear set often need?
3. What do most vehicle manufacturers recommend to minimize the risk of such damage?
4. What problems can occur in OHC engines?
5. What happens when an OHC engine gets too hot?
III. Writing exercises:
Exercise 1
are; receive; suffer

T e x t 7

I. Reading exercises:
Exercise 3
1.b; 2.d; 3.a; 4.c.
Exercise 4
designed; mounts; limited
II. Speaking exercises:
Exercise 2 (suggested questions)
1. How are most performance pipes formed?
2. What configurations are performance mufflers available in?
3. What happens when the stock muffler is removed?
4. What do not direct-fit mufflers usually require?
III. Writing exercises:
Exercise 1
require; connect; is

T e x t 8

I. Reading exercises:
Exercise 3
1.d; 2.a; 3.b; 4.c.
Exercise 4

found; overheated; caused

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What does the radiator also have to be?
2. What must the coolant also have?
3. What is important to keep the cooling system in good operating condition?
4. Where should the level be checked?

III. Writing exercises:

Exercise 1

is; been; causes

T e x t 9

I. Reading exercises:

Exercise 3

1.b; 2.d; 3.a; 4.c.

Exercise 4

is; be; be; have

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What is average service life of an OEM copper/brass radiator?
2. What can kill a radiator?
3. What choice may you have for some applications?
4. Why may not aftermarket radiators always be an exact match with the original?
5. How should the old radiator cap be reused?

III. Writing exercises:

Exercise 1

replaced; damages; make; corroded

T e x t 10

I. Reading exercises:

Exercise 3

1.d; 2.c; 3.a; 4.b.

Exercise 4

are; cause; is

II. Speaking exercises:

Exercise 2 (suggested questions)

1. When do many experts recommend rebuilding or replacing calipers and wheel cylinders?
2. Where do calipers apply the brakes?
3. Why do rotors and drums have wear limits?
4. Why have ceramic-based friction materials become popular in recent years?

III. Writing exercises:

Exercise 1
sets; friction; wear

UNIT 2

T e x t 1

I. Reading exercises:
Exercise 3.
1b; 2a; 3d; 4c.
Exercise 4.
loop; current; motion; alternating; source
II. Speaking exercises:
Exercise 2 (suggested questions)
1. What is an electric machine?
2. How are brushless DC motors constructed ?
3. What does the stationary parts constitute in any motor?
4. How many magnets are there in a practical generator?
III. Writing exercises:
Exercise 1
single; into; from; of; through; in

T e x t 2

I. Reading exercises:
Exercise 3.
1d; 2a; 3b; 4c.
Exercise 4.
focuses; on; cause
II. Speaking exercises:
Exercise 2 (suggested questions)
1. What sub-disciplines does electrical engineering have?
2. How was the subject called prior to the second world war?
3. What is one of the examples of such a circuit?
4. What are electrical engineers usually concerned with?
III. Writing exercises:
Exercise 1
with, of, for, for, on

T e x t 3

I. Reading exercises:
Exercise 3.
1b; 2a; 3d; 4c.
Exercise 4.
circuits; flow; capacitors; filtering; pole
II. Speaking exercises:
Exercise 2 (suggested questions)
1. What is the unit of power?
2. What is the function of diode?
3. What is the concept of Conventional Current still applied to?
4. What types of objects are called resistors?
III. Writing exercises:
Exercise 1
as; across; of; out; to store

T e x t 4

I. Reading exercises:
Exercise 3.
1c; 2a; 3d; 4b.
Exercise 4.
interplay; evolution; minimal; design; limited
II. Speaking exercises:
Exercise 2 (suggested questions)
1. What is a major need of modern electromechanical systems?
2. Where are these techniques utilized?
3. What are modeling functions and where a variety of functional classifications has been proposed?
4. What are current approaches to facilitating computational synthesis primarily focused on?
III. Writing exercises:
Exercise 1
of; by; between; and; of

T e x t 5

I. Reading exercises:
Exercise 3.
1b; 2c; 3d; 4a.
Exercise 4.
elastic; piezo; element; surface
II. Speaking exercises:

Exercise 2 (suggested questions)
1. What types of motions do these equations include?
2. What have they been explored for?
3. Where can one often separate the problem into spatial and temporal parts called separation of variables?
4. Where can the piezo element be cemented on?

III. Writing exercises:

Exercise 1
sensors; active; elastic; space

T e x t 6

I. Reading exercises:

Exercise 3.
1b; 2d; 3a; 4c
Exercise 4.
mathematical; multi-objective; solving; problems; algorithm

II. Speaking exercises:

Exercise 2 (suggested questions)
1. What is used to solve scalar problems?
2. What does the computer based optimization of an electromechanical transducer require?
3. What are priori methods?
4. What influences on problems with a solution time?

III. Writing exercises:

Exercise 1
in; on; for; by

T e x t 7

I. Reading exercises:

Exercise 3.
1c; 2d; 3b; 4a
Exercise 4.
circuit; ammeter's; drop; displayed; amps

II. Speaking exercises:

Exercise 2 (suggested questions)
1.Why are not always easy data sheets to interpret?
2. What does metrology include?
3. Whe do voltmeters read across the circuit or load?
4. What are a typical frequencies of power meters?

III. Writing exercises:

Exercise 1
placed; low; minimal; resistor

T e x t 8

I. Reading exercises:
Exercise 3.
1c; 2a; 3d; 4b
Exercise 4.
used; efficient; difference; fuel; electric
II. Speaking exercises:
Exercise 2 (suggested questions)
1. What two kinds of electric vehicles are currently there in use?
2. What does the cost of fully recharging a battery pack vary with?
3. When do electric vehicles remain cleaner than comparable gasoline-powered vehicles?
4. How does regenerative braking involve slowing and stopping a vehicle?
III. Writing exercises:
Exercise 1.
to; through; what; on; when

T e x t 9

I. Reading exercises:
Exercise 3.
1b; 2a; 3d; 4a
Exercise 4.
closed; from; without; restarts;
II. Speaking exercises:
Exercise 2 (suggested questions)
1. How many major motor control topics or categories are there to consider?
2. How do most overcurrent sources produce extremely large currents?
3. What is the dependence between the overload and the temperature approximation?
4. What is a manual motor starter?
III. Writing exercises:
Exercise 1.
protection; personnel; driven load; categories; types

T e x t 10

I. Reading exercises:
Exercise 3.
1b; 2a; 3d; 4c
Exercise 4.
typically; energy; electricity; motion; any; many
II. Speaking exercises:
Exercise 2 (suggested questions)
1. What does an actuator convert energy into?
2. What most common type of actuator is powered by air?
3. What types of motion can actuators create?
4. Where are hydraulic cylinders often used?
III. Writing exercises:
Exercise 1.
air; cylinders; source; spring; directions

UNIT 3

T e x t 1

I. Reading exercises:
Exercise 3
1b;2d; 3a; 4c
Exercise 4
a DJ's voice; frequency
II. Speaking exercises:
Exercise 2 (suggested questions)
1. How is telecommunication over a phone live called?
2. What is known as modulation?
3. How many modulation schemes are there?
4. What are the differences between digital and analogue signals?
III. Writing exercises:
Exercise 1
to represent, waveform, keying, exist, frequency, shift

T e x t 2

I. Reading exercises:

Exercise 3

1d;2a; 3b;4c

Exercise 4

to carry, copper, calls

II. Speaking exercises:

Exercise 2 (suggested questions)

1. Where can digitized voice data be reproduced?
2. What is the electric signal transformed back into sound by?
3. What kind of system are these phones served?
4. What languages must be translated into machine language?

III. Writing exercises:

Exercise 1

agreement, to handle, conditions, connection

T e x t 3

I. Reading exercises:

Exercise 3

1d;2a;3b;4c

Exercise 4

compression, coding, audio

II. Speaking exercises:

Exercise 2 (suggested questions)

1. How many standards in use are there for analogue television?
2. In what case can the noise alter the decoded message?
3. Where does the choice of modulation vary?
4. Where is analogue television still transmitted?

III. Writing exercises:

Exercise 1

high-powered, high-frequency, receivers, tower, information

T e x t 4

I. Reading exercises:

Exercise 3

1b;2d;3a;4c

Exercise 4

message, IP address, messages, two-way

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What does the nature of computer network communication lend itself to?

2. What will most intercontinental communication use?
3. Are there any certain protocols that are sometimes used and fit in the session and presentation layers?
4. Why do both TCP and UDP packets carry port numbers?

III. Writing exercises:

Exercise 1
model, emerged, attempt, adopted

T e x t 5

I. Reading exercises:

Exercise 3
1d;2a;3b;4c
Exercise 4
Internet; local; a few; require; without

II. Speaking exercises:

Exercise 2 (suggested questions)
1. What gradually moved towards TCP/IP?
2. What allows for more economic set-ups?
3. What does multi-mode fibre suffer from?
4. When did several protocol suites emerged to fill the gap between the data link and applications layer of the OSI reference model?

III. Writing exercises

Exercise 1
TCP/IP; allowed; address; standard; fibre

T e x t 6

I. Reading exercises:

Exercise 3
1b; 2d; 3a; 4c
Exercise 4
normally; quality; noticeable

II. Speaking exercises:

Exercise 2 (suggested questions)
1. What is Moving Picture Experts Group?
2. How many MPEG standards are most popular ones?
3. What is MPEG-4 based on?
4. What do additional features which can be seen in MPEG-4 include?

III. Writing exercises:

Exercise 1
high; storing; two; MPEG

T e x t 7

I. Reading exercises:

Exercise 3

1b; 2d; 3a; 4c

Exercise 4

write; erase; whole

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What is the best way to understand DVD recorders?
2. What have most DVD recorders included?
3. What is the only downside of DVD-RW?
4. Is a DVD recorder a much better choice than a VCR?

III. Writing exercises:

Exercise 1

discussions; advantages; market

T e x t 8

I. Reading exercises:

Exercise 3

1c; 2a; 3d; 4b

Exercise 4

digital; converted

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What is GSM?
2. What does FDM system typically allow one?
3. Why does mobile telephone system all utilize some metho
4. What is GSM together with other technologies?

III. Writing exercises:

Exercise 1

variation; three; compress; streams; slot

T e x t 9

I. Reading exercises:

Exercise 3

1d; 2a; 3b; 4c

Exercise 4

compression; transmitte; retransmit

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What is the maximum possible resolution for GOHZ?
2. Why does the source vary the output voltage?
3. What is DW free from?

4. How do some DVD players and television sets come ?

III. Writing exercises:

Exercise 1

standard; options; competing; digital

T e x t 10

I. Reading exercises:

Exercise 3

1b; 2d; 3a; 4c

Exercise 4

cable; length; less

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What does the transmitter accept?
2. Where is a transmitter?
3. What can the light source cither be?
4. What can you say about the risk of dispersion?

III. Writing exercises:

Exercise 1

apparent; copper; means; span; backbone

UNIT 4

T e x t 1

I. Reading exercises:

Exercise 3

1.d; 2.a; 3.c; 4.b

Exercise 4

hardware; starts up; hardware

II. Speaking exercises:

Exercise 2 (suggested questions)

1.What is an application software?
2.What does a machine language consist of?
3.What does software include?
4. What other languages may software also be written in?

III.Writing exercises:

Exercise 1

processor; binary values; object code; hardware component

T e x t 2

I. Reading exercises:

Exercise 3

1.c; 2.d; 3.b; 4.a

Exercise 4

assembly; non-volatile memory; computer

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What is the function of system software?
2. Where must internal instructions reside at all times while the computer is on?
3. What are the most popular disk operating systems?

III. Writing exercises:

Exercise 1

support; multitasking; assembly; interface; language processor

T e x t 3

I. Reading exercises:

Exercise 3

1.c; 2.d; 3.b; 4.a

Exercise 4

an embedded operating system; an application program

II. Speaking exercises:

Exercise 2 (suggested questions)

1. What kind of computers uses an operating system?
2. What do operating systems offer to application programs and users?
3. What is the first program loaded into a memory when the computer is turned on?
4. Is the operating system the nucleus of all software activity?

III. Writing exercises:

Exercise 1

an operating system; a microprocessor; a machine language; an application; system calls

T e x t 4

I. Reading exercises:

Exercise 3

1.d; 2.a; 3.b; 4.c

Exercise 4

an operating system, domains

II. Speaking exercises:

Exercise 2 (suggested questions)

1. How do you communicate with computer in DOS?
2. How was the program manager in Windows 95 called?
3. What is the successor to both Windows 2000 Professional?
4. Is Windows XP most widely used operating system in the world?

III. Writing exercises:
Exercise 1
a scroll-bar; an editor; a stability; a malware; a data center

T e x t 5

I. Reading exercises:
Exercise 3
1.c; 2.d; 3.b; 4.a
Exercise 4
was, provides, supports

II. Speaking exercises:
Exercise 2 (suggested questions)
1. What is Macintosh?
2. What does the Finder display?
3. Does warp include easy access to networks via modem?
4. What is the central component of Java OS is Java Virtual Machine?

III. Writing exercises:
Exercise 1
RAM; multitasking; multivendor; Virtual Machine

T e x t 6

I. Reading exercises:
Exercise 3
1.c; 2.a; 3.d; 4.b
Exercise 4
detect; hard disc; increase; algorithm

II. Speaking exercises:
Exercise 2 (suggested questions)
1. What can a system profiler provide?
2. What provides a convenient access point for application software?
3. What are network managers?
4. In what way does disk cleaner help the user?

III. Writing exercises:
Exercise 1
a computer resources; a profiler; a backup; a compression

T e x t 7

I. Reading exercises:
Exercise 3
1.d; 2c; 3.a; 4.b

Exercise 4
command choices; on an infinite virtual desktop

II. Speaking exercises:

Exercise 2 (suggested questions)
1. How many common user interfaces are there?
2. Where do information elements appear directly?
3. How do three platforms differ?
4. What is Zooming user interface or zoomable user interface?

III. Writing exercises:

Exercise 1
command driven; various menus; network connectivity; text terminal

T e x t 8

I. Reading exercises:

Exercise 3
1.c; 2.d; 3.a; 4.b
Exercise 4
the kernel of an operating system; instructions; to allow

II. Speaking exercises:

Exercise 2 (suggested questions)
1. What is a device driver?
2. What is the function of interrupts?
3. What is one of the most basic forms of time-sharing?
4. What is the key design goal of device drivers?

III. Writing exercises:

Exercise 1
interrupts; running program; kernel; device drivers; relay information

T e x t 9

I. Reading exercises:

Exercise 3
1.b; 2.d; 3.a; 4.c
Exercise 4
kernel serviced; pass

II. Speaking exercises:

Exercise 2. (suggested questions)
1. What does the kernel of a real-time operating system provide?
2. How many categories of basic services does RTOS kernel supply?
3. What can Random elements in service times cause?
4. What is the key difference between general-computing operating systems and real-time operating systems?

III. Writing exercises:
Exercise 1.
damaged; formulas; random timing; random delays; embedded system

T e x t 10

I.Reading exercises:
Exercise 3.
1.c; 2.a; 3.d; 4.b
Exercise 4.
modularity; modules; high-level languages; executable computer code
II.Speaking exercises:
Exercise 2. (suggested questions)
1. What does a software system consists of?
2. How can the higher-level languages be categorized?
3. What languages are most coding done in?
4. What is the best-known life-cycle model?
III. Writing exercises:
Exercise 1.
executable computer code; executable program; coding phase;programming language; modularity

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