Л.П.Зайцева, М.А.Бух

Микроэлектроника: настоящее и будущее

Пособие по обучению чтению на английском языке.

Допущено Государственным комитетом СССР по народному образованию в качестве учебного пособия для студентов, обучающихся по группе специальностей «Электронная техника»

Москва
«Высшая школа»
1990

ББК81.2Англ-923 311

Рецензенты:

кафедра иностранных языков Кишиневского политехнического института им. С.Г. Лазо (зав. кафедрой канд. филол. наук, доц. В.В. Гончаренко);

д-р филол. наук, доц. Н.М. Разинкина (АН СССР)

Зайцева Л.П., Бух М.А.

3 11 Микроэлектроника: настоящее и будущее: Пособие по обучению чтению на английском языке: Учеб. пособие. - М.: Высш. шк., 1990. -159 с.: ил.

ISBN 5-06- 000209 - 8

Все учебные материалы составлены на основе оригинальных английских и американских источников, отражающих высокие темпы развитая микроэлектроники; расширение областей ее применения в производственных процессах, в сфере бытового обслуживания, в ведущих отраслях народного хозяйства: машиностроении, приборостроении, радиоаппаратостроении, железнодорожном транспорте и др. В пособии широко представлены проблемные задачи, логические опорные схемы. Их цель— активизировать познавательную деятельность студентов, максимально учесть личностный фактор в обучении, оптимизировать самостоятельную работу.

4602020102 (4309000000) - 028 ББК 81.2 Англ-923

001 (00-90 4И (Англ)

Содержание

ПРЕДИСЛОВИЕ

Пособие предназначено для студентов II —IV курсов технических вузов, обучающихся по специальности электроника, вычислительная техника, промавтоматика и др. Им могут пользоваться также научные работники и аспиранты, специализирующиеся в области электронно-вычислительной техники.

Основная цель пособия — развитие и совершенствование навыков чтения и перевода оригинальной литературы по специальности, а также навыков говорения и слушания. Тексты пособия, взятые из оригинальных источников, раскрывают современный уровень достижений в области микроэлектроники и перспективы ее развития в конце XX — начале XXI вв. Многообразие текстов и их объем, а также предлагаемые формы работы моделируют условия реальной информационно-поисковой деятельности специалиста.

Пособие состоит из 6 разделов, охватывающих основные направления развития микроэлектроники и ее применения.

Каждый раздел имеет определенную структуру: это единый учебный цикл, состоящий из двух аудиторных занятий и двух внеаудиторных, на каждом из которых решаются целевые задачи, установленные Программой по иностранному языку для неязыковых вузов (М., 1986).

На первом аудиторном занятии цикла студенты работают с Основным текстом, широко представляющим научные проблемы определенного тематического направления; он содержит базовый терминологический и общенаучный словарь-минимум для чтения оригинальной научно-технической литературы по специальности данного профиля. В основных текстах последовательно представлены структурно-семантические трудности научно-технического текста. Как показывает практика обучения, студенты, впервые приступая к работе с оригинальными текстами большого объема, не владеют в достаточной степени автоматизмами чтения, не умеют автоматически вычленять и синтезировать языковые явления, учитывать их взаимосвязи в тексте.

Главная задача Основного текста — научить зрело читать научно-технические тексты, самостоятельно вести поиск нужной информации, уметь обобщать полученную информацию и углублять профессиональные знания.

Работать с Основным текстом рекомендуется так: студенты быстро просматривают текст для получения установки на правильное восприятие содержания текста при последующем его чтении. Время просмотра — 3 - 5 мин. Затем приступают к особому виду перевода текста под руководством преподавателя: студенты выполняют перевод вслух «для себя», линейно-последовательно воспринимая текст; в процессе перевода автоматически выявляют связи слов, их подчиненность или главенство и взаимодействие на основе определенных внешних признаков. При таком переводе студент может прогнозировать значение неизвестных ему ранее слов, исходя из синтаксических и логико-смысловых связей текста. При неправильном выявлении связей преподаватель подает команду «ошибка». Студент реагирует на команду или исправлением ошибки, или ждет помощи. Помощь осуществляется в виде краткого указания преподавателя на причину ошибочного действия студента.

Весь процесс мыслительных операций происходит «открыто», что дает возможность сразу производить коррекцию неправильных действий читающего. Студент имеет обратную связь относительно своих действий.

Данная методика обучения чтению апробирована в течение нескольких лет и дает положительные результаты.

Работая над Основным текстом, а также дополнительными, студенты учатся определять тему текста по ключевым словам и фрагментам, овладевают приемами компрессии текста, обобщения содержания.

Самостоятельная работа после первого аудиторного занятия направлена на расширение словарного запаса. Слова, выделенные в тексте, даны в поурочном словаре, который составлен по гнездовому принципу. Эти слова вынесены в алфавитный указатель, который позволяет быстро найти нужное слово в соответствующем разделе пособия. Интенсивная повторяемость базового словаря в текстах и упражнениях обеспечивает его усвоение в полном объеме. Все задания для этого вида работы предполагают активное использование языковых средств в формируемых рецептивных и продуктивных видах речевой деятельности.

Второе аудиторное занятие включает достаточно обширный информативный текстовой материал для различных видов чтения. Скорость чтения и глубина понимания регулируется типом заданий. Обучение чтению организуется как процесс постоянного решения речемыслительных задач, что обеспечивает эффективное усвоение языковых средств и их перенос в условиях новых контекстов и речевых ситуаций.

Задания носят творческий характер и направлены на формирование профессионально значимых умений и навыков работы с литературой по специальности — находить и определять степень новизны и информативности материала, определять перспективы развития, проводить сопоставительный анализ прочитанных текстов, а также уметь изложить информацию в обобщенном виде (планы, тезисы, аннотация, таблицы, структурно-логические схемы и денотатные графы) и вести беседу по изученным темам и проблемам своей специальности.

Самостоятельная работа после второго аудиторного занятия направлена на обобщение всей информации раздела с опорой на знания, полученные в процессе изучения спецдисциплин и дополнительных источников на родном и иностранном языках. Задания ориентированы на активное обсуждение проблем, лежащих в русле профессиональной подготовки будущих специалистов, а также на систематизацию основных понятий, на формирование понятийного аппарата по специальности.

По окончании курса обучения предлагается организовать групповую (курсовую) конференцию по проблемам микроэлектроники на английском языке.

Авторы выражают глубокую благодарность д.т.н. проф. Л.А. Коледову и д.т.н. проф. В.А. Протопопову за консультации по отбору материала для данного пособия.

Авторы

РАЗДЕЛ ПЕРВЫЙ

Основной текст: Electronics and Microelectronics.

Грамматические явления: Определительные блоки существительного. Их перевод и способы вычленения. Выявление синтаксических функций слов/словосочетаний в структуре английского предложения. Способы перевода предложений со словом it.

Лексические явления: Контекстуальные значения слов pattern, involve, point. Перевод слов с префиксами dis-, in-, ir-, un-, non-, mal-.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ (ЗАНЯТИЕ ПЕРВОЕ)

Проверьте, знаете ли вы следующие слова.

1) intensive a, evolution n, quantitative a, complex a, qualitative a, human a, demonstrate v, enormous a, extraordinary a, reduction n, term n, conductor n, control v, decade n, contain v, discrete a, individual a, universal a, manufacture v, separately adv, final a, concept n, reality n, series n, fabrication n, integrated a, radiation n

2) increase v, size n, cost n, lead (led) v, steady a, change n, invention n, circuit n, tube n, application n, advantage n, consumption n, create v, invisible a, depend v, measure v, device n, flow n, related n, development n, shape n, solve v, major a, common a, divide v, density n, achieve v, accept v, demand v, reach v, wave n

Ознакомьтесь с терминами Основного текста.

1. electronic technology — технология электронных приборов
2. solid-state components — твердотельные компоненты, полупроводниковые компоненты
3. capacitor —конденсатор
4. overall reliability — надежность системы
5. integrated circuit — интегральная схема
6. substrate — подложка
7. charge carrier —носитель заряда
8. metal-oxide semiconductor —полупроводник МОП структуры
9. field-effect transistor — транзистор с полевым эффектом
10. chip — кристалл; интегральная схема
11. small-scale integrated circuit (SSI) — интегральная схема с малой степенью интеграции
12. medium-scale integrated circuit (MSI) — интегральная схема со средней степенью интеграции, ИС
13. large-scale integrated circuit (LSI) - интегральная схема с большой степенью интеграции, большая интегральная схема, БИС
14. very-large-scale integrated circuit (VLSI) - интегральная схема со сверхбольшой степенью интеграции, сверхбольшая интегральная схема, СБИС
15. circuit pattern — рисунок схемы, схема

ОСНОВНОЙ ТЕКСТ

1. Переведите первую часть (I) Основного текста в аудитории устно под руководством преподавателя.
2. Просмотрите вторую часть (II) Основного текста и кратко изложите ее содержание по-русски. Назовите ключевые английские слова, которые способствовали пониманию текста.

ELECTRONICS AND MICROELECTRONICS

I. The intensive effort[1] of electronics to increase the reliability[2] and performance[3] of its products while reducing their size and cost has led to the results that hardly anyone would have dared to predict.[4]

The evolution of electronic technology is sometimes called a revolution. What we have seen has been a steady quantitative evolution: smaller and smaller electronic components performing increasingly complex electronic functions at ever higher speeds. And yet there has been a true revolution: a quantitative change in technology has given rise to qualitative change in human capabilities.[5]

It all began with the development of the transistor.

Prior to[6] the invention of the transistor in 1947 its function in an electronic circuit could be performed only by a vacuum tube. Tubes came in so many shapes and sizes and performed so many functions that in 1947 it seemed audacious (слишком смело) to think that the transistor would be able to compete[7] except in limited applications.

The first transistors had no striking advantage in size over the smallest tubes and they were more costly. The one great advantage the transistor had over the best vacuum tubes was exceedingly[8] low power consumption. Besides they promised greater reliability and longer life. However it took years to demonstrate other transistor advantages.

With the invention of the transistor all essential circuit functions could be carried out[9] inside solid[10] bodies. The goal[11] of creating electronic circuits with entirely solid-state components had finally been realized.[12]

Early transistors, which were often described as being a size of a pea (горошина), were actually enormous on the scale[13] at which electronic events[14] take place, and therefore they were very slow. They could respond[15] at a rate[16] of a few million times a second; this was fast enough to serve in radio and hearing-aid (слуховой аппарат) circuits but far below the speed needed for high-speed computers or for microwave communication systems.

It was, in fact, the effort to reduce the size of transistors so that they could operate at higher speed that gave rise to the whole technology of microelectronics.

A microelectronic technology has shrunk[17] transistors and other circuit elements to dimensions[18] almost invisible to unaided eye (невооруженный глаз).

The point[19] of this extraordinary miniaturization is not so much to make circuits small per se (лат. сами по себе) as to make circuits that are rugged (зд. массивный), long-lasting, low in cost and capable of performing electronic functions at extremely high speeds. It is known that the speed of response depends primarily on the size of transistor: the smaller the transistor, the faster it is.

The second performance benefit[20] resulting from microelectronics stems directly from the reduction of distances between circuit components. If a circuit is to operate a few billion times a second the conductors that tie the circuit together must be measured in fractions of an inch. The microelectronics technology makes close coupling[21] attainable.[22]

It may be helpful if we say a few words about four of the principal devices found in electronic circuits: resistors, capacitors, diodes and transistors. Each device has a particular[23] role in controlling the flow of electrons so that the completed circuit performs some desired function.

During the past decade the performance of electronic systems increased manifold[24] by the use of ever larger numbers of components and they continue to evolve. Modern scientific and business computers, for example, contain 10^9 elements; electronic switching[25] systems contain more than a million components.

The tyrany of numbers — the problem of handling[26] many discrete electronic devices — began to concern[27] the scientists as early as 1950. The overall[28] reliability of the electronic system is universally related to the number of individual components.

A more serious shortcoming[29] was that it was once[30] the universal practice to manufacture[31] each of the components separately and then assemble[32] the complete device by wiring[33] the components together with metallic conductors. It was no good (зд. Это не помогло): the more components and interactions, me less reliable the system.

The development of rockets and space vehicles[34] provided the final impetus[35] to study the problem. However, many attempts were largely unsuccessful.

What ultimately[36] provided the solution was the semiconductor integrated circuit, the concept[37] of which had begun to take shape a few years after the invention of the transistor. Roughly between 1960 and 1963 a new circuit technology became a reality. It was microelectronics development that solved the problem.

The advent[38] of microelectronic circuits has not, for the most part, changed the nature of the basic functional units: microelectronic devices are also made up of transistors, resistors, capacitors, and similar[39] components. The major difference is that all these elements and their interconnections are now fabricated on a single substrate[40] in a single series of operations.

II. Several key[41] developments were required before the exciting potential of integrated circuits could be realized.

The development of microelectronics depended on the invention of techniques[42] for making the various functional units on or in a crystal of semiconductor materials. In particular, a growing number of functions have been given over to circuit elements that perform best: transistors. Several lands of microelectronic transistors have been developed, and for each of them families of associated circuit elements and circuit patterns[43] have evolved.

It was the bipolar transistor that was invented in 1948 by John Bardeen, Walter H.Brattain and William Shockley of the Bell Telephone Laboratories. In bipolar transistors charge carriers of both polarities are involved[44] in their operation. They are also known as junction[45] transistors. The npn and pnp transistors make up the class of devices called junction transistors.

A second kind of transistor was actually conceived almost 25 years before the bipolar devices, but its fabrication in quantity did not become practical until the early 1960's. This is the field-effect transistor. The one that is common in microelectronics is the metal-oxide-semiconductor field-effect transistor. The term refers[46] to the three materials employed in its construction and is abbreviated MOSFET.

The two basic types of transistor, bipolar and MOSFET, divide microelectronic circuits into two large families. Today the greatest density of circuit elements per chip[47] can be achieved with the newer MOSFET technology.

An individual integrated circuit (IC) on a chip now can embrace (включать) more electronic elements than most complex piece of electronic equipment that could be built in 1950.

In the first 15 years since the inception of integrated circuits, the number of transistors that could be placed on a single chip (with tolerable[48] yield[49]) has doubled every year. The 1980 state of art[50] is about 70K density per chip. Nowadays we can put a million transistors on a single chip.

The first generation of commercially produced microelectronic devices are now referred to as small-scale integrated circuits (SSI). They included a few gates.[51] The circuitry defining[52] a logic array[53] had to be provided by external conductors.

Devices with more than about 10 gates on a chip but fewer than about 200 are medium-scale integrated circuits (MSI). The upper boundary[54] of medium-scale integrated circuits technology is marked[55] by chips that contain a complete arithmetic and logic unit. This unit accepts as inputs two operands and can perform any one of a dozen or so operations on them. The operations include additions, subtraction, comparison, logical "and" and "or" and shifting[56] one bit to the left or right.

A large-scale integrated circuit (LSI) contains tens of thousands of elements, yet each element is so small that the complete circuit is typically less than a quarter of an inch on a side.

Integrated circuits are evolving from large scale to very-large-scale (VLSI) and wafer-scale integration (WSI).

The change in scale can be measured by counting the number of transistors that can be fitted[57] onto a chip.

Continued evolution of the microcomputer will demand further increases in packing[58] density.

There appeared a new mode[59] of integrated circuits, microwave integrated circuits. In broadest sense,[60] a microwave integrated circuit is any combination of circuit functions which are packed together without a user accessible[61] interface.

The evolution of microwave integrated circuits must begin with the development of planar[62] transmission lines.[63]

As we moved into the 1970's, stripline and microstrip assemblies became commonplace and accepted as the everyday method of building microwave integrated circuits. New forms of transmission lines were on the horizon, however. In 1974 new integrateв-circuit components in a transmission line called fineline appeared. Other more exotic techniques, such as dielectric waveguide[64] integrated circuits emerge.[65] Major efforts currently are directed at such areas as image guide, co-planar waveguide, fineline and dielectric waveguide, all with emphasis on techniques which can be applied to monolithic integrated circuits. These monolithic circuits encompass all of the traditional microwave functions of analog circuits as well as new digital applications.

Microelectronic technique will continue to displace other modes. As the limit of optical resolution[66] is now being reached, new lithographic and fabrication techniques will be required. Circuit patterns will have to be formed with radiation having wavelength shorter than those of light, and fabrication techniques capable of greater definition will be needed.

Electronics has extended[67] man's intellectual power. Microelectronics extends that power still further.

Проверьте, как вы запомнили слова.

1.1. Переведите следующие слова/словосочетания, исходя из значений, приведенных в скобках:

1. reliable a (надежный), rely v, reliability n; 2. predict v (прогнозировать), prediction n, predicted performance; 3. capable я (способный), capability n, logic capability; 4. excess n (превышение), exceed v, in excess of, exceedingly high; 5. scaling n (масштабирование), scale n, on a large scale; 6. response n (реакция), respond v, responsibility n, responsible a, to be responsible for, time response; 7. benefit v (приносить выгоду, пользу), benefit n, for the benefit of, without the benefit; 8. evolution n (развитие), evolve v; 9. concern n (дело, отношение, интерес), concern v

1.2. Определите значения английских слов, исходя из контекста:

1. прилагать большие efforts; 2. reliability—это качество любой машины; 3. performance любой задачи, performance схемы; 4. capability памяти человека; 5. competition между фирмами; 6. to exceed предел; 7. scale of измерения; 8. prediction of результатов; 9. to respond на сигнал; 10. экономическая benefit

1.3. Переведите следующие слова. Обратите внимание на то, что префиксы dis-, in-, un-, mal-, non-, ir- придают словам значение отрицания.

dis-: discharge v, disconnect v, disclose v, disadvantage n, disappear v
in- : invisible a, inaccurate a, inactive a, incapable a, incompact a
un-: unbalance v, unbelievable a, unconventional a, uncontrollable a
mal-: malfunction n, malpractices, malformed a
non-: non-effective a, non-metallic a, nonconductor n
ir-: irregular a, irrelative a, irresistible n

Обсудите содержание текста.

1.4. Просмотрите Основной текст еще раз. Ответьте на вопросы, используя информацию текста.

1. What would you say about electronics? 2. What would you say about the invention of the transistor? 3. What were the advantages of the first transistors over the best tubes? 4. What would you say about the early transistors? 5. Why is the size of transistors of prime importance? 6. What is the second performance benefit resulting from microelectronics? 7. What are the

principal elements of electronic circuits? 8. What does the overall reliability of electronic systems depend upon?

1.5. Сделайте обобщение информации о разработке транзисторов и интегральных схем (выполняется устно).

1.6. Просмотрите вторую часть (II) Основного текста. Сообщите, что вы узнали о:

1. the development of microelectronics; 2. several kinds of microelectronic transistors; 3. bipolar amd metal-oxide-semiconductor field-effect tranistors; 4. the first generation of microelectronic devices

Проверьте, умеете ли вы переводить определительные блоки существительного.

1.7. Ознакомьтесь с типами определительных блоков существительного.

1.A + N/A + N

1) a small device, a small electronic device, a smaller device, the smallest possible device

2) a low consumption, a lower consumption, a lowest possible consumption, the least possible consumption

3) any complex function, more complex function, a most complex function, the most complex function, the most possible complex function, the least possible complex function

4) good shapes, better shapes, best shapes, bad shapes, worse shapes, the worst shapes

2.Adv+A +N

1) extremely high cost, entirely new application, increasingly complex technology, highly important invention

2) a far heavier unit, a far lower pressure, a far faster flow

3) a much faster change, a much denser population

4) a little longer operation, a little more serious attempt

3.A +N + N/A +N

1) a large time interval, a high flow temperature, different air speeds, low temperature growth

2) high-speed computers, high-quality device, thin-film technology, single-layer structure

4.V_{ing}+N/Adv+V_{ing}+N

1) an increasing size, a decreasing number, an operating device

2) a constantly increasing size, a steadily decreasing number, a slowly operating device

5.V_{ed}+N/Adv+V_{ed}+N

1) achieved results, changed operations, produced devices

2) quickly achieved results, partially changed operations, commercially produced devices

6.Adv + V_{ed}+N

1) a much needed development, a much controlled addition

2) a round-shaped piece, a low-powered transmitter

7.N + N/N + N + N

1) process control —control process, cost reduction — reduction cost, test operation — operation test

2) power consumption — power consumption change, circuit element — circuit element decrease, size reduction — size reduction need

8.N-V_{ing}+N/N-V_{ed}+N

1) current-controlling device, man-operating machine, electron-emitting source

2) consumption-related process, man-made change, error-operated system

1.8. Переведите следующие определительные блоки существительного:

1. several basic functional units; 2. semiconductor device fabrication; 3. device application; 4. progressively thinner layers; 5. widely accepted unit; 6. relatively cheap source material; 7. power-producing element; 8. commercially produced microelectronic devices

1.9. Найдите определительные блоки существительного (с левым определением):

1. An equally systematic approach will be required in the new generation integrated circuits fabrication. 2. One recently invented microelectronic functional element has a distinction. 3. Today's microcomputer has more computing capacity than the first large electronic

computer.

1.10. Переведите определительные блоки существительного (с правым определением) или бессоюзные определительные предложения:

1) the number of circuit components; the use of low gas velocities; the achievement of much less high temperature; the advantage of carefully prepared silicon surfaces; rapidly developing technology of smaller electronic components

2) a description of the properties of circuit elements; the theme of a great number of publications

3) the computer compares the information it receives; the designer considers the size the chip has

Проверьте, умеете ли вы выявлять синтаксические функции слов/словосочетаний в структуре английского предложения.

1.11. Переведите следующие словосочетания с предлогами, где они являются указателями функции обстоятельства N^3:

at: to move at extremely high speeds; to buy at ever lower cost after: to develop after the invention of transistor; after the development of integrated circuits; after 1970's

before: before the publication of the paper; before the device fabrication

by: to accomplish by introducing diodes; to be introduced by 1960; the cost decreased by then to a tenth of the 1976 cost during: to control during crystal growth for: the electronic component for a circuit; for many purposes the size was changed; for five years; for the most part of the year

from: from the very beginning; from the experiment results; to separate semiconductor from a metal

in: advantages in size; changes in cost; in the early 1960's; in this field of developments; an important technique in semiconductor device fabrication; in addition to integrated circuit fabrication; in terms of units; to need control in progressively thinner layers; in the presence of silicon; to be low in cost; in a year

on: the effects of reactor design and operation on these parameters; to depend on the invention; on the basis of the high density; on the chip

over: over the past decade, the advantage of a new concept over the previous one

with: with the development of transistor; to achieve with new technology, with each technical development

within: within the period of operation; within five years

1.12. Прямое дополнение N^2 — указатель неявной формы сказуемого. Переведите следующие предложения:

1. Microelectronics faces many problems. 2. Mark the temperature increase. 3. The structural and electrical properties of films pose interesting problems. 4. The lens focuses the beam on a small spot on the object. 5. The paper presents a perspective of the system potential.

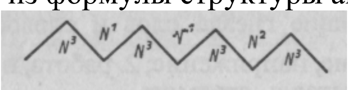
1.13. Явная форма сказуемого V^1 — указатель подлежащего N^1. Переведите следующие предложения:

1. Polycrystalline semiconductor films have shown useful device applications. 2. Reduced epitaxial growth temperatures have been achieved in conventional silane-in-hydrogen systems.

1.14. Наречие выполняет функцию обстоятельства N^3 в структуре предложения. Переведите следующие предложения:

1. Early transistors were actually enormous in size. 2. Thin films are commonly deposited by evaporation. 3. Transistor performance was steadily improved.

1.15. Определите функцию слов/определительных блоков в данных предложениях, исходя из формулы структуры английского предложения:



1. Continued progress in microelectronics may depend to a significant extent on our

ability to predict properties from a knowledge of the steps taken in the fabrication. 2. The interconnections of the integrated circuit are much more reliable than solder joints. 3. The primary means of cost reduction has been the development of increasingly complex circuits.

1.16. В следующих предложениях it не переводится. Объясните, почему:

1. It was possible (necessary) to increase the functions of the device. 2. It was clear (apparent) that low power consumption is of importance. 3. It was the development (appearance) of the transistor that changed the picture. 4. It is supposed (believed) that the transistor had an advantage over the best vacuum tubes. 5. It appears (seems, proves) that the object of the research is significant.

Учитесь читать.

Текст 1.1. Прочитайте текст. Скажите, что вы узнали о: а) electronic industry; б) films. Прочитайте текст еще раз. Озаглавьте его.

Even before the invention of the transistor the electronics industry had studied the properties of thin films of metallic and insulating materials. Such films range in thickness from a fraction of a micron, or less than a wavelength of light, to several microns. (A micron is a millionth of a meter; the wavelength of red light is about .7 micron.)

Текст 1.2. Прочитайте текст. Скажите, что вы узнали о: а) resistor; б) zigzag pattern; в) capacitance. Прочитайте текст еще раз. Озаглавьте его.

A typical thin-film resistor consists of a fine metal line only a few thousandths of an inch wide and long enough to provide the desired value of resistance. If high precision is required laser trimming is used. If high values are desired, the line can be laid down in a zigzag pattern. To form a capacitance one can lay down a thin film of insulating material between two thin films of metal.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ПЕРВОГО ЗАНЯТИЯ)

Изучите следующие гнезда слов и словосочетаний.

1. effort n 1. усилие, напряжение; 2. работа, программа
in an effort пытаясь, стремясь
design effort конструкторская работа
research effort программа исследований, исследовательская работа
development effort программа опытных работ
2. reliability n надежность
reliable a надежный; прочный
rely on/upon v 1, полагаться на; 2. опираться на
3. performance n 1. рабочая характеристика; параметры; 2. работа, функционирование
circuit performance параметры схемы
perform v выполнять, осуществлять; совершать
4. predict v прогнозировать
prediction n прогнозирование predictive a предсказуемый
5. capability n 1. способность, возможность; 2. характеристика
output capability выходная характеристика capable a способный
6. prior to prp до, ранее prior о предшествующий
priority n 1. приоритет, первенство; 2. предшествование
7. compete v соревноваться; конкурировать
competition n соревнование; конкуренция
competitive a конкурирующий; сопоставимый; конкурентноспособный
8. exceedingly adv чрезвычайно
exceed v превышать
excess n превышение; избыток
in excess of более чем; сверх, дополнительно
9. carry out v выполнять; проводить

carry on v продолжать

carry v 1. нести; 2. поддерживать; 3. проводить carrier n носитель, держатель

10. solid n твердое тело

solid-state твердотельный; полупроводниковый

11. goal n цель, задача

12. realize v 1. представлять себе; 2. осуществить; достигнуть realization n 1. понимание; 2. достижение; осуществление

real a действительный

reality n действительность, факт

really adv действительно, на самом деле

13. scale n 1. шкала, масштаб; 2. размер, величина; 3. степень

14. event n 1. явление, событие; 2. результат, исход

eventual a 1. возможный; 2. конечный

eventually adv в конце концов

15. respond v реагировать

response n реакция; ответ

time response временная характеристика

16. rate n 1. темп, скорость; 2. класс, разряд; 3. порция, норма

ratio n 1. пропорция, отношение; 2. коэффициент

17. shrink (shrank, shrunk) v сокращаться; уменьшаться

shrinkage n сокращение; уменьшение

18. dimension n 1. размер; величина; объем; 2. важность

dimensional a имеющий измерения, пространственный

19. point n 1. точка; 2. место; 3. вопрос; 4. суть; цель

point of view точка зрения

in point рассматриваемый

pointless a бессмысленный

point v указывать, показывать

point out v указывать

20. benefit n выгода, польза

benefit v помогать; приносить пользу; выигрывать

for the benefit of для, ради

without the benefit не используя

21. coupling n соединение

coupler n соединительный прибор

couple n 1. пара; 2. элемент

22. attainable я достижимый

attain v достигнуть

attainment n приобретение

23. particular a 1. особый; специфический; 2. индивидуальный

in particular в особенности

particularly adv 1. особенно; 2. в частности

24. manifold adv во много раз

manifold a разнообразный

fold v 1. складывать; 2. дублировать

25. switch v переключать, включать

switch n переключатель

switch off v выключать

switch on v включать

switching n переключение, коммутирование

26. handling n 1. обработка; 2. управление; 3. выполнение

handle v 1. управлять; 2. иметь дело с чём-л.; 3. справиться

handler n устройство; манипулятор
27. concern n 1. дело, касательство; 2. интерес, участие; 3. важность
concerned a имеющий отношение; заинтересованный
concerning prp относительно
as far as smth is concerned что касается
28. overall в 1. полный, общий; 2. предельный
overall dimensions габаритные размеры
overall efficiency общий коэффициент полезного действия
29. shortcoming n 1. недостаток; 2. нехватка
short a 1. короткий; 2. недостаточный; 3. дефицитный
shortage n нехватка
30. once adv 1. когда-то, раньше; 2. (один) раз
once again еще раз
once and again несколько раз
more than once не раз, неоднократно
at once сразу, быстро
once n один раз
once со когда, если; как только
once in a while иногда
31. manufacture v изготовлять; выделывать
manufacturer n 1. изготовитель; 2. промышленник; предприниматель
manufacturing n производство; обработка
32. assemble v собирать, монтировать
assembly n 1. сборка, монтаж; 2. агрегат
assembler n 1. установка для сборки; 2. ассемблер (язык)
33. wiring n 1. разводка; 2. монтаж
wire n проволока; провод
wire v связывать; формировать разводку
wiry a проволочный
34. vehicle n 1. средство передачи; 2. носитель (кристаллов); 3. вид транспорта
35. impetus n импульс, стимул
36. ultimately adv в конце концов; в конечном счете
ultimate a 1. последний; 2. основной
37. concept n 1. теория; 2. общее представление
conception n 1. точка зрения; 2. понимание
conceive v понимать, представлять себе
conceivable a возможный, мыслимый
concept phase стадия предварительного проектирования
38. advent n 1. появление; 2. прибытие
39. similar я подобный, сходный
similarly adv аналогично
similarity n сходство, аналогия
40. substrate n = substratum 1. подложка; 2. основание; 3. необработанная подложка
41. key n 1. ключ; 2. ключ (к упражнениям и т.п.); 3. переключатель, кнопка
keyboard n клавиатура; коммуникационная панель
42. technique n метод, технический прием
Cp. technology n 1. техника; технические науки; 2. технология
technicals n техническая терминология
CAD technique метод автоматизированного проектирования
circuit technique схемотехника
definition technique метод формирования рисунка
43. pattern n 1. образец, шаблон; 2. форма; положение; характер; 3. структура (на

фотошаблоне); 4. стиль

patterning n формирование структуры, рисунка; структурирование

pattern v 1. формировать рисунок; 2. копировать

44. involve v 1. иметь; включать в себя; 2. вызывать; быть связанным с чём-л.; 3. требовать

involved в рассматриваемый

45. junction n 1. соединение; 2. переход (р-п); 3. точка соединения

junction transistor плоскостной транзистор; транзистор ср-п переходом

46. refer v 1. отсылать; упоминать; 2. направлять; 3. передавать на рассмотрение

to be referred to as называться

reference n 1. ссылка; источник; 2. отношение; 3. эталон; 4. передача на рассмотрение

references n библиография

voltage reference источник опорного напряжения

47. chip n 1. кристалл; 2. интегральная схема, ИС; микросхема, чип; 3. кусочек, обломок

array chip матричная ИС

bare chip бескорпусная ИС

component chip бескорпусный компонент

custom chip заказная ИС

fast chip быстродействующая ИС

gate array chip базовый кристалл типа матрицы логических элементов

individual circuit chip кристалл с малой степенью интеграции

master chip базовый кристалл

microchip микропроцессорная БИС

speech chip ИС синтезатора речи

chip-outs дефектные кристаллы

chipper n однокристальный микропроцессор

48. tolerable я допустимый

tolerance n допустимое отклонение от стандарта

49. yield n 1. размеры выработки; 2. выход годных (схем)

yield v давать (результаты); производить

50. state of art состояние вопроса; уровень развития науки

state n 1. состояние, положение; 2. государство

state v 1. констатировать; 2. заявлять stated в 1. установленный; 2. регулярный

statement n утверждение

51. gate n 1. затвор, клапан; 2. логический элемент; 3. строб-импульс

diode transistor-logic gate элемент ДТЛ

discrete gate 1. логический элемент на дискретных компонентах; 2. логическая ИС с малой степенью интеграции

intrinsic gate затвор из п/п с собственной электропроводимостью

two-input gate логический элемент с двумя входами

52. define v 1. определять; 2. обозначать

definite a 1. определенный; 2. точный

definition n 1. определение; 2. четкость

53. array n 1. масса, массив, множество; 2. перечень, порядок; 3. матрица; 4. расположение

cell array матрица ячеек

image array матрица изображений структур

piggyback array размещение одной ИС над другой

arrange v 1. располагать; 2. конструировать

arrangement n 1. расположение, порядок; 2. прибор, конструкция

basic-circuit arrangement принципиальная схема
matrix arrangement матричная схема
mounting arrangement монтажно-сборочное приспособление
sandwich-type arrangement трехслойная структура
54. boundary n граница
bound n 1. граница; 2. предел
bound v 1. ограничивать; 2. граничить
55. mark v 1. обозначать, маркировать; 2. характеризовать
mark n 1. знак; 2. показатель, признак; 3. норма
marking n маркировка
chip marking маркировка ИС
marked a заметный
markedly adv заметно, значительно
56. shifting n смещение
shift v 1. перемещать, сдвигать; 2. изменять
shift n 1. сдвиг; изменение; 2. перемена
logical shift логический сдвиг
shifter n сдвиговый регистр
level shifter схема сдвига уровня
57. fit v 1. устанавливать; 2. годиться; 3. подгонять
fit a 1. подходящий; 2. готовый
58. pack v упаковывать; корпусировать; укладывать
pack n 1. корпус, упаковка; 2. сборка; блок
package n 1. корпус, упаковка; 2. модуль; 3. монтаж в корпусе
packing n 1. модуль, корпус; 2. набивка, уплотнение
59. mode n 1. метод, способ; 2. режим; 3. форма, вид
charge-storage mode режим накопления заряда
failure mode вид отказа
in-line production mode поточный метод производства
simulation mode имитационная модель
60. sense n 1. смысл, значение; 2. ощущение
sensitive a 1. чувствительный; 2. прецизионный
sensor n датчик
61. accessible я доступный
access n доступ
62. planar a планарный, плоскостной; плоский
63. line n 1. линия; 2. контур; 3. ряд, расположение
transmission line линия передачи
stripline полосковая линия
fineline a прецизионный; с элементами уменьшенных размеров
64. waveguide n волновод
wave n волна
65. emerge v 1. появляться, возникать; 2. выясняться
emergence n 1. появление; 2. выход
66. resolution n 1. разрешающая способность; 2. решение
resolve v 1. распадаться, разлагаться; 2. решать
resolved a 1. растворимый; 2. решенный
resolving power разрешающая способность
67. extend v 1. расширяться; 2. увеличиваться; 3. распространяться
extended a 1. обширный; 2. продолжительный
extension n 1. расширение, растяжка; 2. удлинение; 3.распространение
extensive a обширный

extent n 1. размер, величина; 2. степень, мера

to a certain extent до некоторой степени

Проверьте, как вы запомнили слова.

(1 —10) in an effort to get a reliable unit; the performance of a device; to predict the achievement; exceedingly high resistance

(11 — 20) the goal of creating IC; the speed of response depends; to respond at a rate of a few million times a second; capacitors are difficult to shrink; the microscopic dimensions of new circuits; the point of discussion; the performance benefit resulting from microelectronics

(21 — 30) close coupling of computer conductors; the power consumption is of designer concern; the shortcoming of the device

(31 — 40) difficulty of manufacturing of switching systems; to assemble circuit modules; the impetus to new studies; to lead to similarity; the advent of a new concept; to mount devices on a substrate

(41 — 50) to provide a new manufacturing technique; to involve changes; the transistor is a two-junction Jevice; the term refers to the material; base regions on each chip

(51 — 67) the third electrode called the gate; in the common mode of operations

Задания к Основному тексту.

1.17. Устно переведите вторую часть (II) Основного текста; обобщите ее содержание на русском или английском языке.

1.18. Найдите в Основном тексте английские эквиваленты следующих речевых отрезков:

1. увеличивать надежность электронных приборов; 2. до изобретения транзистора; 3. низкий расход энергии; 4. уменьшение расстояния между элементами схемы; 5. характеристики электронных систем улучшились во много раз; 6. появление микроэлектронных схем; 7. микроэлектронные приборы состоят из

1.19. Изложите кратко содержание Основного текста на английском языке. Основная тема сообщения: Electronics began with the development of the transistors. Используйте следующие клише:

1. The evolution of (integrated circuits) must begin with the development of...; 2. In the broad sense (an integrated circuit) is a combination of...; 3. As (chip density) increases ...; 4. The (circuit density) begins ...; 5. It appears that (the process) ...; 6. In summary, (the integrated circuit) offers ...

Проверьте, сможете ли вы перевести.

1.20. Переведите следующие определительные блоки существительного:

1. computer-aided design; 2. intensive efforts; 3. several key developments; 4. low power consumption; 5. entirely solid-state components; 6. small-scale integrated circuits; 7. complete arithmetic and logic unit; 8. modern scientific and business computers; 9. commercially produced microelectronic devices; 10. metal-oxide semiconductor field-effect transistor technology; 11. a steady quantitative evolution; 12. an attainable response; 13. entirely new handling; 14. ever-growing number; 15. performance benefit; 16. dimensional tolerance; 17. fineline lithography; 18. plasma-etching process; 19. materials research; 20. defect-free silicon; 21. reflection mode; 22. ever low cost; 23. much larger market; 24. widening range of applications

1.21. Выявите определительные блоки существитель-ных. Определите их структуру и функцию в предложении. Переведите предложение, опуская определения.

1. With the invention of the transistor all essential circuit] functions could be carried out inside solid bodies. 2. Plasma etch-ing results in large increase in etch rate. 3. The process is a chemi-cal vapour reaction conducted under reduced pressure conditions. 4. The electrical resistance of a metal wire is a disruption of the orderly movement of electrons by interactions with the atomic structure of the material.

Учитесь читать и переводить.

Текст 1.3. Переведите текст письменно со словарем, I обращая внимание на перевод глаголов implies embraces, come и существительных body, art

It should first be made clear what the term "microelectronics" implies. Microelectronics embraces the entire body of the electronic art which is connected with, or applied to, the realization of electronic circuits, subsystems, or the entire systems from extremely small electronic devices. The terms "microelectronics" and "integrated circuits" are sometimes used interchangeably, but | this is not correct.

Microelectronics is a name for extremely small electronic i components and circuit assemblies, made by thin-film, thick-film or semiconductor techniques.

An integrated circuit (IC) is a special kind of microelectronics. It is a circuit that has been fabricated as an inseparable assembly of electronic elements in a single structure. It cannot be divided without destroying its intended electronic function. Thus, ICs come under the general category of microelectronics, but all microelectronic units are not necessarily ICs.

Текст 1.4. Прочитайте текст; найдите в нем информацию о сущности интегральной электроники. Обобщите прочитанное в виде аннотации на английском языке. Схему аннотации см. после текста.

Integrated Electronics

Integrated electronics is a field so new and so fast changing that many interested people have difficulty keeping up with its day-to-day developments. There is even some confusion con cerning what integrated electronics is and what its significance is for the development of science and technology.

The essence of integrated electronics is batch (партия; группа) processing. Instead of making, protecting, testing and assembling individual (or discrete) components one at a time, large groupings of these components together with their interconnections are made now, all at a time. The resulting new entity, or "integrated component", therefore, is an assemblage of old-style components interconnected into circuits, networks, or even subsystems. Hence, for a given system function the number of separate components have been greatly reduced, while system capability has been greatly increased.

Integrated electronics will develop further. First, the efforts are being made to get more and more circuit functions on slice of silicon which means cramming (размещение) even more circuit elements into still smaller areas. Second, integrated electronics will move not only towards more functions per slice, but toward new types of functions.

Рекомендуемая схема аннотации:

1. The author examines... ; 2. He considers...; 3. Details are given of...; 4. The consequence of the development is...; 5. In the future...

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ
(ЗАНЯТИЕ ВТОРОЕ)

Проверьте домашнее задание.

1.22. Ответьте развернуто на следующие вопросы:

1. What were the most important facts for the development of electronics? microelectronics? 2. Why could not early transistors satisfy the needs of the growing high-speed computers industry and microwave communication systems? 3. What is the major difference between electronic systems and microelectronic devices?

1.23. Вычлените определительные блоки, определите их функцию в предложении; предложение переведите.

For a very large chip with extremely small geometries, the time delay associated with interconnections could become an appreciable portion of the total time delay, and hence the circuit performance could no longer be decided by the device performance.

Учитесь читать и переводить.

Текст 1.5. Прочитайте текст. Составьте прогноз содержания текста на основе ключевых слов. Озаглавьте текст.

Прочитайте текст еще раз и составьте его аннотацию на английском языке. Схема аннотации:

1. This review briefly surveys developments in the field of...; 2. It shows the advantages and disadvantages of...; 3. An attempt is made to deal with...; 4. Actually, the structure of the components permits...

The potential of integrated circuits is so wide that in addition to replacing similar discrete component circuits they are responsi- ble for creating a completely new technology of circuit design.

There are two basic approaches to modern microelectron-ics — monolithic integrated circuits and film circuits.

In monolithic ICs all circuit elements, active and passive, are simultaneously formed in a single small wafer of silicon. The ele- ments are interconnected by metallic stripes deposited onto the oxidized surface of the silicon wafer.

Monolithic IC technology is an extension of the diffused pla- nar process. Active elements (transistors and diodes) and passive elements (resistors and capacitors) are formed in the silicon slice by diffusing impurities into selected regions to modify electrical characteristics, and where necessary to form p-n junctions. The various elements are designed so that all can be formed simultaneously by the same sequence of diffusions.

Film circuits are made by forming the passive electronic component and metallic interconnections on the surface of an insulation substrate. Then the active semiconductor devices are added, usually in discrete wafer form. There are two types of film circuits, thin film and thick film.

In thin film circuits the passive components and interconnection wiring are formed on glass or ceramic substrates, using evaporation techniques. The active components (transistors and diodes) are fabricated as separate semiconductor wafers and assembled into the circuit.

Thick film circuits are prepared in a similar manner except that the passive components and wiring are formed by silk-screen techniques on ceramic substrates.

There can be many instances where the microelectronic circuit may combine more than one of these approaches in a single structure, using a combination of techniques.

In multichip circuits the electronic components for a circuit are formed in two or more silicon wafers (chips). The chips are mounted side by side on a common header. Some interconnections are included on each chip, and the circuit is completed by wiring the chips together with small diameter gold wire.

Hybrid IC's are combinations of monolithic and film techniques. Active components are formed in a wafer of silicon using the planar process, and the passive components and interconnection wiring pattern formed on the surface of silicon oxide which covers the wafer, using evaporation techniques,

Текст 1.6. Прочитайте текст. Напишите его краткое содержание, используя модель:

1. The paper attempts to provide ...
2. ... are discussed briefly.
3. They include ...
4. The conclusion is as follows...

<u>Integrated Circuit Development</u>

Three factors have contributed to the rapid development growth in the number of circuit elements per chip.

One factor is improvement in techniques for growing large single crystals of pure silicon. By increasing the diameter of the wafers —the discs of silicon on which chips are manufactured — more chips can be made at one time, reducing the unit cost.

Moreover, the quality of the material has also been unproved, reducing the number of defects per wafer. This has the effect of increasing the maximum practical size of a chip because it reduces the probability that a defect will be found within a given area. The chip size for large-scale integrated circuits has grown from less than 10.000 square mils (thousandths of an inch) to

70.000.

A second factor is improvement in optical lithography, the process whereby all the patterns that make up a circuit are ultimately transferred to the surface of the silicon. By developing optical systems capable of resolving finer structures, the size of a typical transistor, as measured by the gate length, has been reduced from a few thousandths of an inch in 1965 to two microns today.

Finally refinements in circuit structure that make more efficient use of silicon area have led to a hundredfold increase in the density of transistors on the chip.

Текст 1.7. Переведите текст письменно без словаря. Значения выделенных слов вы сможете понять из контекста. Время перевода - 10 минут.

Electronic Devices

The invention of the transistor triggered the rapid growth of the electronics industry. Before transistors, electronic circuits were large, bulky and unreliable. They consumed considerable power (energy) and therefore generated too much heat, which contributed to the deterioration of other circuit parfs and materials, such as resistors, capacitors and insulation. With transistors, circuits became much smaller, more efficient in the use of energy, and far more reliable. The higher reliability of the transistor circuits compared to vacuum tube equivalents is an extremely important advantage.

The techniques used to manufacture transistors led to the development that made it possible to mass-produce very small and highly reliable electronics circuits commonly known as integrated circuits (ICs). ICs have diodes, transistors, resistors and all inter- connecting leads formed on a single piece of semiconductor mate-

Текст 1.8. Переведите текст письменно со словарем. I Время перевода —15 минут.

The Future of ICs

When assessing the future course of ICs, it is customary to project another order of magnitude in circuit performance through a continuing reduction in the feature size of the devices on chip.

However, at our current level of IC development we must face several pragmatic barriers that will require some degree of research creativity to overcome. For example, the chip complexity is extrapolated to 100,000,000 transistors per chip and beyond.

However, the latest models indicate that the power level of next-generation devices will be on the order of 10 mW. Thus, a chip of this extrapolated complexity with these devices would require 1000 watts of input power and a packaging system capable of dissipating such power. Since these small devices would operate at reduced supply voltages, the 1000 watts of input power would require currents on the order of 200 amperes and perhaps greater on a chip that should be less than one square inch in area. This set of conditions would apply only to a high-duty cycle and high-performance design and points out that important complexity/performance trade-offs must occur.

Conductors that are compatible with the device geometries must carry current densities much greater than the allowable limits defined by electromigration effects, resulting in a low reliability.

Определите контекстуальное значение выделенных слов.

1.24. Переведите, обращая внимание на контекстуальное значение выделенных слов pattern, poin, involve 1. Optical lithography has been the leading integrated circuit pattern defining technique for many years. 2. In the narrow sense, pattern recognition means the classification of a given unknown pattern into a number of standard classes. In broad sense, pattern recognition means scene analysis. 3. Electron beam changes physical characteristics of exposed resistor so that after chemical etching pattern is left on clear substrate. 4. Finished substrate may contain 10,000 mask patterns. 5. The amount of work done is moving one coulomb of electricity from one point to another is a measure of the potential difference between these two points. 6. The principles involve preparing detailed plans and careful monitoring. 7. The circuitry and software involved can be standardized. 8. Plasma etching involves the use of a glow discharge. 9. This work has involved the contributions of many people.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ВТОРОГО ЗАНЯТИЯ)

Учитесь читать.

Текст 1.9. Прочитайте текст. Кратко изложите его содержание на русском языке. Озаглавьте текст.

As more ways are found to jam circuitry onto silicon chips, a new barrier to smaller and faster computers is emerging. The plastic or ceramic package that carries electrical signals on wires in and out of the chip is still bulky—sometimes 20 times as big as the chip.

One solution, promoted by National Semiconductor Cooperation and others, is tape automated bonding. Instead of the wires and prongs (штырь) now used to connect chips, connections are etched into copper foil. These connections are five times closer together than the prongs are. IBM has tried abandoning chip packages altogether, connecting the chips directly to a surface containing multiple levels of wiring.

Учитесь говорить.

1.25. Подтвердите или опровергните прогнозы о развитии электроники на 80 - 90-е годы, высказанные специалистами в 70-е годы. Используйте следующие выражения:

1. As far as I know... 2. To my knowledge... 3. For all I know... 4. Intensive efforts have been devoted to... 5. The efforts continue in the direction of... 6. It appears that the (process) will... 7. To sum up...

1. Further developments in thick and thin film circuits will extend the range of values achievable using deposition and evaporation techniques, although some applications may still require "pellet" type components. 2. Hybride microwave devices will decrease in importance as true microwave integrated circuits become more economical. 3. The use of an electron beam instead of a light beam in the photographic process will result in integrated circuits with vastly increased numbers of functions per chip. 4. Materials other than silicon will be used, and other phenomena and structures besides junction barriers formed byp and n impurities can be considered.

1.26.1. Дайте определение типов интегральных схем; 2. Обсудите проблемы использования полупроводников; 3. Обсудите преимущества микроэлектроники; 4. Расскажите об электронных компонентах, используя структурно-логическую схему:

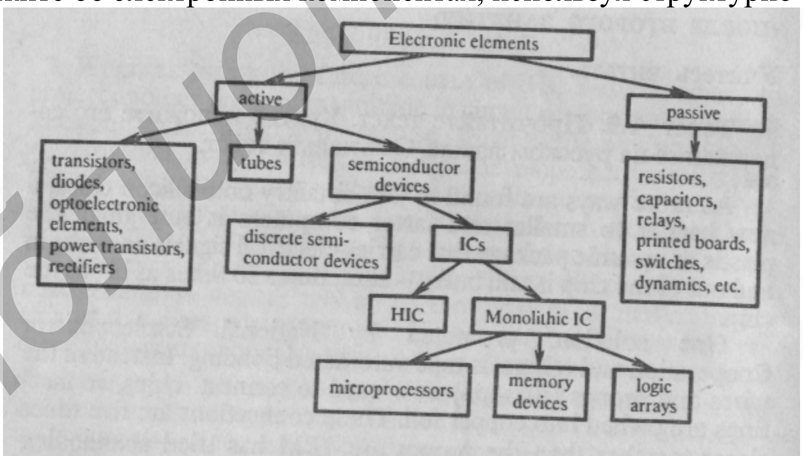


Рис. 1

Ознакомьтесь с терминологией.

1.27. Переведите следующие термины. Запомните их:

Chip: array chip; face-down chip; base chip; bipolar chip; component chip; gate array chip; dense chip; fast chip; master chip; math chip; chip-carrier

Gate: discrete gate; insulated gate; intrinsic gate; transistor gate; two-input gate; diode-transistor-logic gate

Junction: back-to-back junction; blocking junction; intrinsic-extrinsic junction; isolation junction

РАЗДЕЛ ВТОРОЙ

Основной текст: Semiconducting Materials Engineering Progress.

Грамматические явления: Типы левого определения. Способы их выявления и перевода. Перевод слов one(s), that, those.

Лексические явления: Контекстуальное значение слов maintain, turn. Перевод слов с префиксами sub-, super-, over-, under-, semi-.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ
(ЗАНЯТИЕ ПЕРВОЕ)

Проверьте, знаете ли вы следующие слова.

1) accompany v, focus v, area n, approximation n, associate v, effect n, portion n, total a, dominate v, limit v, variety n, emit v, operate v, start v, patent v, uniformity n, composition и, oxide n, oxygenn, form v, minority n, ingradient a, fabrication n, defect n

2) reduction n, size n, resistance n, tremendous a, scale n, performance n, cause v, dimension n, goal n, available a, property n, research n, propose v, apply v, provide v, yield n, occur v, selectivee, serve v, achieve v, efforts n, remain v, introduce v, require v, improve v, follow v, develop v

Ознакомьтесь с терминами Основного текста.

1. feature size — размер элемента
2. time delay — временная задержка
3. net effect — чистый эффект
4. intrinsic semiconductor - собственный полупроводник
5. band gap - ширина запрещенной зоны

ОСНОВНОЙ ТЕКСТ

1. Переведите первую часть (I) Основного текста в аудитории устно под руководством преподавателя.

2. Просмотрите вторую часть (П) Основного текста и кратко изложите ее содержание по-русски.

SEMICONDUCTING MATERIALS ENGINEERING PROGRESS

I. In microelectronics, the steady reduction of IC feature[1] sizes, accompanied by high current densities and increasing demands on electrical performance, has focused the attention of technologists on newer materials which exhibit[2] characteristics such as low contact resistance, reduced vulnerability[3] to electromigration, and processibiliry[4] at low temperatures.

Over the years, the device size has been reduced tremendously. Improvements available[5] in materials technology have allowed integration of more and more devices on the same chip, resulting in increased area. According to the theory of scaling, the smaller dimensions of a MOS transistor should enhance[6] its speed. As a first-order approximation, therefore, this should proportionally increase the circuit speed. Indeed, for smaller circuits it does happen. However, for large circuits, the time delays[7] associated with the interconnections can play a significant[8] role in determining[9] the performance of the circuit.

As the minimum feature size is made smaller, the area of cross section of the interconnection also reduces. At the same time a higher integration level[10] allows the chip area to increase, causing the lengths of the interconnections to increase. The net[11] effect of this "scaling of interconnections" is reflected into an appreciable[12] RC time delay. For a very large chip with extremely small geometries, the time delay associated with interconnections could become an appreciable portion of the total time delay, and hence the circuit performance could no longer be decided by device performance.

Thus, as the chip area is increased and other device-related[13] dimensions are decreased the interconnection time delay becomes significant compared to the device time delay and dominates the chip performance. These are dominant factors limiting device performance.

Performance is the obvious goal of VLSI; reliability is a more subtle[14] one. Therefore, new materials are required for VLSI interconnections.

The design[15] of any machine or a device has always been limited by the materials available. The problem in question was that materials could be designed and tailored[16] for any new structures.

Semiconductors are used in a wide variety of solid-state devices including transistors, integrated circuits, diodes, photodiodes and light-emitting diodes.

Several elements in and around group IV of the Periodic Table show intrinsic[17] semiconductor properties but of these Ge and Si (and to a lesser extent Se) alone have shown chemical and electrical properties suitable[18] for electronic devices operating near room temperature.

Germanium and silicon were the first semiconductor materials in common[19] use.

A great contribution[20] to the study of semiconductor physics has been made by the prominent Soviet scientist A.F.Yoffe. It was in 1930 when Academician A.Yoffe and his co-workers started a systematic research in the field of semiconductors.

The diffusion theory of rectification[21] on the boundary of the two semiconductors was elaborated by B.I.Davydov, a Soviet physicist, in 1938. Experimental support of his theory was of great importance in the investigation of processes occurring[22] in p-n junctions.

Right after World War П, physicists John Bardeen, Walter Brattain and William Shockley, and many other scientists, turned[23] full time to semiconductor research. Research was centered on the two simplest semiconductors — germanium and silicon.

Experiments lead to new theories. For example, William Shockley proposed an idea for a semiconductor amplifier[24] that would critically test the theory. The actual device had far less amplification than predicted. John Bardeen suggested a revision theory that would explain why the device would not work and why previous experiments had not been accurately foretold by older theories. In new experiments designed to test the new theory they discovered an entirely new physical phenomenon — the transistor effect. In 1948 W.Shockley patented the junction transistor. Junction transistors are essentially solid-state devices having three layers of alternately[25] negative or positive type semiconductor material.

The early history of modern semiconductor technology can be traced[26] to December 1947 when J.Bardeen and W.H.Brattain observed transistor action through point contacts applied to poly-crystalline germanium. Germanium has become the material in common use. It was realized that transistor action occurred within the single grains[27] of polycrystalline material.

G.K.Teal originally recognized[28] the immense[29] importance of single-crystal semiconductor materials as well as for providing the physical realization of the junction transistor. Teal reasoned[30] in 1949, that polycrystalline germanium's uncontrolled resistances and electronic traps[31] would affect[32] transistor operations in uncontrolled ways. Additionally,[33] he reasoned that polycrystalline material would provide inconsistent product yields and thus be costly. He was the first to define chemical purity,[34] high degree of crystal perfection[35] and uniformity of structure as well as controlled chemical composition (i.e. donor or acceptor[36] concentration) of the single-crystal material as an essential foundation for semiconductor products.

The next decade witnessed[37] an ingermanium and the "universal" semiconductor material, silicon. Silicon gradually gained[38] favour over germanium as the "universal" semiconductor material.

Silicon is to the electronics revolution what steel was to the Industrial Revolution.

II. Silicon has been the backbone (основа) of the semiconductor industry since the inception of commercial[39] transistors and other solid-state devices.

The dominant role of silicon as a material for microelectronic circuits is attributable[40] in large part to the properties of its oxide. Silicon dioxide is a clear glass with a softening[41] point higher than 1,400 degrees C. If a wafer[42] of silicon is heated in an atmosphere of oxygen or water vapour,[43] a film of silicon oxide forms on its surface. The film considered is hard and durable[44] and adheres[45] well. It makes an excellent insulator. The silicon dioxide is particularly important in the fabrication of integrated circuits because it can act as a mask[46] for selective introduction of dopants.[47]

Silicon's larger band[48] gap[49] permitted[50] device operation at higher temperatures (important for power devices) and thermal oxidation of silicon produced a non-water-soluble stable oxide (as compared to germanium's oxide) suitable for passing p -n junctions, serving as an "impermeable[51] diffusion mask" for common dopants, and as insulator coating[52] for conductor overlayers.[53]

Oxygen concentration present influences many silicon wafer properties, such as wafer strength, resistance to thermal warping (скачок), minority carrier lifetime and instability in resistivity.

The presence of oxygen contributes to both beneficial and detrimental[54] effects. The detrimental effects can be reduced if the oxygen is maintained[55] at less than 38 ppms. Thus, the oxygen range[56] of the wafer present should be controlled. The results achieved with silicon are great.

However, although the silicon wafer clearly is a fundamental ingradient in the fabrication of an integrated circuit, the silicon materials specification[57] may not be critical element in developing a successful new IC product strategy. If silicon material is to remain the semiconductor device material for the next ten years efforts must continue to reduce crystallographic defects, grown-up impurities introduced during device fabrication.

Large-scale integration (LSI) of devices has put great demands on electronic-grade single-crystal material. The semiconductor industry now requires high purity and minimum point-defects concentration in silicon in order to improve the component yield per silicon wafer. These requirements have become increasingly stringent[58] as the technology changes from large-scale integration (LSI) to very large-scale integration (VLSI) and very high speed integrated circuits (VHSIC).

The yield (or circuit performance) of a device and the intrinsic and extrinsic materials properties of silicon are interdependent. The silicon wafer substrate must be practically defect-free when the active device density may be as high as 10^5 to 10^6 per chip.

To increase further the speed of semiconductor devices requires not only refinements[59] in present designs and fabrication techniques, but also new materials that are inherently[60] superior to materials presently being used, like germanium and silicon. New material under consideration is gallium arsenide.

Gallium arsenide has a much higher electron mobility than germanium and silicon. The opportunities[61] present are as follows: it is potentially much faster; it has a larger band gap, permitting operation at higher temperatures; it is chemically and mechanically stable. Mobilities in this high-purity gallium arsenide are about twice those of germanium and four times those of silicon.

The potential of high-purity gallium arsenide was first explicit[62] in a new gallium arsenide-germanium hetero-junction diode. The hetero-junction device has a potential for much faster switching than conventional[63] p-n junction diodes. Its calculated switching time is on the order of a few picoseconds (trillions of a second).

However, the difficulty of producing gallium arsenide of sufficient[64] purity has limited its application.

Yet, gallium arsenide is far from the end of the story. Any searching for an answer makes contributions. This is the way of developing better materials and devices.

Проверьте, как вы запомнили слова.

2.1. Переведите следующие слова, исходя из значений, приведенных в скобках:

1. densityn (плотность), dense a; 2. vulnerability n (уязвимость), vulnerable a; 3. processibility n (обработка), process v; 4. interconnection n (взаимосвязь), connect v; 5. suitable a (пригодный), suit v; 6. contribution n (вклад), contribute v; 7. rectification n (выпрямление), rectify v; 8. amplification n (усиление), amplify v; 9. layer n (слой), lay v; 10. alternately adv (попе ременно), alter v; 11. perfection n (совершенствование), perfect v; 12.

purity n (чистота), pure a; 13. commercial a (имеющийся в продаже), commerce n

2.2. Переведите следующие слова, исходя из значения их антонимов:

1. unstable a (stable a - устойчивый); 2. unconventional a (conventional a - обычный); 3. unlimited a (limited a — ограниченный); 4. uncontrolled a (controlled a—управляемый); 5. unsuitable a (suitable a — подходящий); 6. uncommon a (common o —обычный); 7. unlike a (like a—подобный); 8. impossible a (possible a —возможный); 9. imperfect a (perfect a — идеальный); 10. impurity n (purity n —чистота); 11. immobilityw (mobility n — подвижность)

2.3. Определите значения английских слов, исходя из контекста:

1. новые материалы, которые exhibit другие характеристики; 2. чем меньше dimension проводника, тем больше; 3. наблюдается delay по времени; 4. эти явления associated with с явлениями проводимости; 5. более высокий level интеграции; 6. to develop материал для новых схем; 7. полупроводники обладают suitable свойствами для электронных приборов; 8. был сделан contribution в полупроводниковую физику; 9. процессы occurring в полупроводниках, показывают; 10. история развития может быть traced, начиная с 1947 года; 11. постепенно кремний gained favour над германием.

2.4. Переведите глаголы, исходя из значений соответствующих существительных:

1. delay v (delay n —задержка); 2. level v (level n — уровень); 3. feature v (feature n — характеристика); 4. turn v (turn n — поворот); 5. trace v (trace n — след); 6. reason v (reason n — разум; причина)

2.5. Переведите следующие слова. Обратите внимание на значения префиксов sub-—под, ниже, super-, over-— сверх, выше, under- — выше и semi- — полу:

sub-: subdivision n, substructure n, subcommittee n

super-: superheat n, superstructure n, supernatural a, super-fast a

over-: overgrow v, overwork v, overheat v

under-: underproduce v, undergrow v, undercoat v, undercutting n

semi-: semiconductor n, semicircle n, semiannual a

Обсудите содержание текста.

2.6. Просмотрите текст еще раз (I часть). Ответьте на вопросы, используя информацию текста.

1. What would you say about the steady reduction of IC feature sizes? 2. What has allowed the integration of more and more devices on the same chip? 3. What does higher integration level allow? 4. What are the dominant factors limiting device performance? 5. What limits the design of any machine? 6. Who has made a great contribution to the study of semiconductor physics? 7. What would you say about polycrystalline materials? 8. What is essential foundation for semiconductor products?

2.7. Обобщите информацию, данную в тексте. Расскажите, что вы узнали о полупроводниках; об ученых, работающих в области полупроводниковых материалов; о кремнии и германии.

2.8. Просмотрите вторую часть (П) текста. Сообщите, что вы узнали о:

1. dominant role of silicon as a material; 2. silicon dioxide; 3. a film of silicon; 4. a non-water soluble oxide; 5. presence of oxygen in silicon; 6. silicon wafer; 7. point-defects concentrations; 8. gallium arsenide

Проверьте, умеете ли вы переводить определительные блоки указанных типов.

1) Блок типа N + Vyd/3 form

1. The state of art influenced by the development of ...

2. The prediction followed by the change of the pattern ...

3. The event faced by the designers ...

4. The wire joined completes ...

2) Блок типа N + $V_{ed/3aorm}$ +prp

1. The capability relied upon is reached ...

2. The technique referred to in the paper responds ...

3. The benefit called for can be achieved...
4. The array thought of points out that ...
3) Блок типа N + V_{to}
1. The concept to be referred to evolves ...
2. The point to be reached exceeds...
3. The mode to be considered stems from...
4. The reliability to be achieved reaches ...
4) Блок типа A + enough + V_{to}
1. The impetus strong enough to give rise to...
2. The shift large enough to be considered...
3. The vehicle heavy enough to handle...
4. The shrink small enough not to be considered...
5) Блок типа Num + (N) +A
1. The shrink 5 cm long is marked ...
2. The unit 4 m high...
3. The film .1 mm thick...
6) Блок типа N +A типа available
1. Improvement available is...
2. Performance necessary can...
3. Chip area present is ...
4. Technology similar to the previous one is ...
5. The shift possible is used ...
7) Блок типа N + in/under + N
1. The prediction in question gives...
2. The event under consideration shows...
3. The vehicle in operation reaches...
4. The pattern in use marks...
5. The chip under development provides ...
8) Блок типа N + Ving (+ N^2)
1. The wire linking the ends was ...
2. The wire being linked completes ...
3. The benefit predicting the result fits ... The benefit being predicted is...
4. The reliability concerning the device points ... The reliability being concerned stems from...
9) Блок типа N + $V_{ed/3\ form}$
1. The dimension required is responsible for... The dimension required the shift of ...
2. The concept produced fits...
The concept produced an impetus...
3. The response achieved is ... The response achieved the value of...

2.9. Найдите существительные с левым определением. Определите их функцию в предложении и переведите:

1. The high level of control of film thickness and resistivity uniformity required has led to the study of the kinetics of the deposition. 2. Time delay associated with the interconnection is dependent on two parameters. 3. The markedly different growth rate observed implies that gas phase equilibrium is not established.

2.10. Найдите и переведите речевые отрезки, в которых слова one(s) и that, those являются заместителями существительного.

one, ones: 1. one or more units; 2. one more unit; 3. one more advantage; 4. one or more advantages; 5. one single crystal; 6. one of the benefits; 7. not a static field but a dynamic one; 8. not a special acceptor but a common one; 8. one may make an effort; 9. one can predict; 10. complete ones; 11. applicable ones

that, those: 1. is like that of a substrate; 2. is much more than that produced recently, 3. is lower than that provided by a new technique; 4. are more beneficial than those of new pattern

Учитесь читать.

Текст 2.1. Прочитайте текст. Скажите, что вы узнали о silicon, active and passive elements. Прочитайте текст еще раз. Озаглавьте его. Данные ниже слова/словосочетания помогут вам понять текст.

1. far from being —далеко от; 2. at all —вообще; 3. abundance — множество

All the components of the circuit must be fabricated in a crystal of silicon or on the surface of the crystal. Silicon is far from being ideal material for these functions and only modest values of resistance and capacitance can be achieved. Practical microelectronic inductors cannot be formed at all. On the other hand, silicon is a material without equal for the fabrication of transistors, and the abundance of these active components in microelectronic devices more than compensates for the shortcomings of the passive elements.

Текст 2.2. Переведите текст письменно без словаря. Время перевода —10 минут. Значения выделенных слов вы сможете понять из контекста.

HBTs

Most recently research efforts have led to the fabrication of hetero-junction bipolar transistors (HBTs) based on GaAs and other Ш-V compounds. These new devices offer the prospect of obtaining performance features similar to those of Si bipolar transistor translated to substantially higher frequency.

HBTs have large amounts of current and power gain and millimeter-wave frequencies.

Devices are fabricated on semi-insulating GaAs substrates and maybe monolithically integrated, together with thin-film resistors and Shottky diodes, using conventional GaAs IC techniques.

Their current handling capability input voltage dc matching, breakdown voltage, and I/O noise are potentially better than those for GaAs FETs. Based on these characteristics, HBTs are expected to have abright future in microwave/millimeter-wave ICs.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ПЕРВОГО ЗАНЯТИЯ)

Изучите следующие гнезда слов и словосочетаний.

1. feature n 1. особенность; свойство; 2. деталь
feature size размеры элемента
feature v 1. изображать, показывать; 2. быть характерной чертой
2. exhibit v 1. показывать, проявлять; 2. экспонировать
exhibition n 1. показ; 2. выставка
3. vulnerability и уязвимость
vulnerable a уязвимый
4. processibility n возможность обработки
processing n обработка
process n 1. процесс; 2. способ
process v обрабатывать
processor n процессор
5. available a 1. доступный; имеющийся в распоряжении; 2. (при)годный
availability n 1. наличие; 2. пригодность
6. enhance v повышать; увеличивать; усиливать
7. delay я 1. задержка, препятствие; 2. замедление
delay v 1. задерживать; 2. откладывать
8. significant в важный; значимый
significance n важность; значение
9. determine v 1 определять, устанавливать; 2. решать; 3. заставлять; 4. ограничивать
determination n 1. определение; решение; 2. установление
10. level n 1. уровень; 2. плоская горизонтальная поверхность

level a 1. одинаковый; 2. горизонтальный
level v выравнивать; уравновешивать
11. net n 1. сеть; 2. схема, цепь
network n 1. схема, цепь; 2. сеть
12. appreciable с заметный, ощутимый
appreciate v 1. оценивать, ценить; 2. различать
13. related a связанный; относящийся
relate v связывать; относиться
relationship n отношение
14. subtle a 1. тонкий; 2. острый; 3, искусный
15. design n 1. проект, план; 2. конструкция, разработка; 3. рисунок, эскиз; 4. расчет
design v 1. проектировать, конструировать; 2. предназначать
designer n конструктор, проектировщик
computer-aided design автоматизированное проектирование
block design блочная конструкция
fault-tolerant design отказоустойчивая конструкция
geometry design топологическое проектирование схем
on-line circuit design оперативное проектирование схем
option design проектирование с выбором вариантов
16. tailor v приспосабливать, подгонять
tailoring n подгонка, подстройка
field tailoring подстройка поля
17. intrinsic a 1. присущий, свойственный; 2. существенный; внутренний; 3. собственный (об электропроводниках)
extrinsic a примесный (об электропроводниках)
18. suitable a 1. подходящий, соответствующий; 2. годный
suit v 1. удовлетворять требованиям; 2. соответствовать
19. common a 1. общий; 2. простой, обыкновенный; 3. распространенный
in common вместе
commonly adv обычно
20. contribution n 1. вклад; 2. содействие; участие; 3. сотрудничество; работа; статья, доклад
contribute v 1. содействовать, способствовать; 2. делать
вклад; 3. принимать участие, сотрудничать
contributor n 1. автор статьи; 2. содействующий
21. rectification n 1. выпрямление; 2. детектирование
rectify v 1. выпрямлять; 2. детектировать
barrier-layer rectification выпрямление на обедненном слое
diode rectification диодное детектирование
rectifier n 1. выпрямитель; 2. диод
tunnel rectifier выпрямитель на туннельном диоде
22. occur v 1. происходить, случаться; 2. приходить на ум; 3. встречаться, попадаться
occurrence n 1. случай; 2. наличие; 3. местонахождение,
распространение; 4. возникновение
failure occurrence возникновение отказа
23. turn v 1. вращаться; 2. обращаться, прибегать; 3. сосредоточивать, направлять; 4. приводить в какое-л. состояние
turn n 1. поворот; 2. изменение; 3. очередность
in turn по очереди
24. amplifier n усилитель
bulk-effect amplifier усилитель на основе объемного эффекта

charge-transfer amplifier усилитель на ППЗ
off-chip amplifier навесной (внешний) усилитель
on-chip amplifier усилитель на одном кристалле с другой схемой
sample-and-hold amplifier усилитель выборки и хранения
sense amplifier усилитель считывания
amplify v усиливать; увеличивать
25. alternately adv попеременно
alternate a 1. чередующийся; 2. другой
alter v чередовать; изменяться
alternating в переменный
26. trace v 1. прослеживать; 2. проводить пинию; 3. относить к; относить на счет
trace n 1. след; 2. незначительное количество
traceability: batch traceability возможность контроля последовательности технологической обработки партии (пластин)
27. grain n кристалл; гранула; зерно
grain v гранулировать
columnar grain зерно цилиндрической формы
28. recognize v 1. узнавать; 2. признавать
recognizable a могущий быть узнанным
recognition n 1. узнавание; опознавание; 2. признание
29. immense в 1. огромный; 2. необъятный
immensely adv очень, чрезвычайно
30. reason v 1. обсуждать; рассуждать; 2. резюмировать
reason n причина; основание
reasonable в умеренный; приемлемый
31. trap n ловушка; центр захвата
carrier-trap центр захвата носителей
electron trap электронная ловушка, центр захвата электронов
trap v захватывать
32. affect v оказывать влияние, воздействовать
affected a нарушенный, поврежденный
33. additionally adv дополнительно
additional a дополнительный
addition n 1. дополнение; 2. сложение
in addition to 1. дополнительно, кроме того
addv прибавлять; дополнять
34. purity n чистота; беспримесность
impurity n примесь
pure a чистый, беспримесный
purely adv исключительно; полностью; совершенно, вполне
purify v очищать
35. perfection n 1. завершенность, законченность; 2. совершенство
perfect a 1. законченный; 2. идеальный
perfect v 1. заканчивать; 2. совершенствовать
perfectly adv совершенно
36. acceptor n 1. акцептор; 2. акцепторная примесь
accept v 1. принимать; 2. допускать; соглашаться
acceptable в приемлемый; допустимый
37. witness v 1. быть свидетелем; 2. свидетельствовать
38. gain v 1. получать; приобретать; 2. увеличиваться; 3. извлекать пользу
gain n 1. увеличение, прирост; 2. прибыль; 3. выигрыш; 4. коэафициент усиления
collector-to-base current gain коэффициент усиления транзистора по току в схеме с

общим эмиттером

current gain усиление по току

logic gain нагрузочная способность логической ИС

speed gain выигрыш в быстродействии

39. commercial a 1. торговый; 2. выгодный; 3. имеющийся на рынке

commerce n торговля

40. attributable в причастный; характерный

attribute n свойство, характерный признак, черта

attribute v относить; приписывать

41. soften v размягчать

soft a 1. мягкий; 2. ковкий; гибкий

software n математическое обеспечение ЭВМ

42. wafer n 1. полупроводниковая пластина; 2. пластинка; плата; подложка; 3. кристалл, ИС

bipolar wafer п/п пластина с биполярными интегральными структурами

building-block wafer п/п пластина с сформированными конструктивными блоками

customed wafer п/п пластина с базовыми кристаллами

etch-separated wafer п/п пластина, разделяемая на кристаллах методом травления

flat-wafer пластина с плоскопараллельными поверхностями

process development wafer тестовая пластина, применяемая при разработке технологического процесса

wafering n резка п/п слитков на пластины

wafertrack n автоматизированная система обработки п/п пластин, управляемая микропроцессором

43. vapour n пар, пары

dopant vapour пары легирующей примеси

vaporization n испарение; парообразование

44. durable a 1. прочный; 2. длительный, долговременный

durability n 1. прочность; 2. продолжительность, срок службы

duration n продолжительность

45. adhere v 1. прилипать; 2. придерживаться чего-л.

adherence n 1. соединение, сцепление; 2. соблюдение

adhesion n прилипание, сцепление

adhesive n 1. клей, адгезив; 2. адгезия

46. mask n фотошаблон, маска; маскирующий слой

mask v маскировать

deposition mask шаблон для формирования металлизации

doping mask шаблон для формирования легированных областей

evaporation mask маска для напыления

exposure mask 1. фотошаблон; 2. фоторезистный маскирующий слой

in situ mask локальная маска

master mask эталонный оригинал фотошаблона

metal-on-glass mask металлизированный фотошаблон

moving mask свободная маска

overlaid mask маска на п/п пластине

production mask рабочий шаблон

self-aligned mask самосовмещенный шаблон

maskant n материал для формирования маскирующего слоя

47. dopant n легирующая примесь; диффузант

donor dopant донорная примесь

implanted dopant ионноимплантируемая примесь

impurity dopant легирующая примесь

spin-on dopant примесь, наносимая на поверхность п/п
doped a легированный
doper n установка для легирования
dope v легировать
doping n легирование
48. band n 1. полоса частот; 2. лента, тесьма
49. gap n 1. промежуток, интервал; 2. пробел, пропуск; 3. разрыв, зазор
band gap запрещенная зона
direct gap запрещенная зона с прямыми переходами
graded band gap плавно изменяющаяся запрещенная зона
mask gap зазор между фотошаблоном и п/п пластиной
proximity gap микрозазор
50. permit v позволять; разрешать
permission n разрешение
permissible a разрешаемый, допустимый
51. impermeable a непроницаемый
permeate v проникать
52. coating n 1. покрытие, слой; 2. нанесение покрытия
dip coating нанесение покрытия методом погружения
53. overlayer n покрытие, верхний слой
layer n слой, пласт; пленка
lay v 1. класть, положить; 2. излагать, формулировать; 3. составлять план
barrier layer запирающий слой
buried layer скрытый слой
cap layer герметизирующий слой
evaporated layer напыленный слой
host layer исходный слой
multiple layer многослойная пленка
registered layers совмещенные слои
sandwiched layers слои трехслойной структуры
supported semiconductor layer п/п слой на подложке
layout n топология; разработка топологии
54. detrimental a вредный, нежелательный
detriment n вред
55. maintain v 1. поддерживать, сохранять; 2. обслуживать; 3. продолжать; 4. утверждать
maintenance n 1. уход, ремонт; 2. поддержка; 3. обслуживание
56. range n 1. ряд; цепь; 2. область распространения; 3. предел, диапазон; 4. протяженность
range v 1. классифицировать; 2. колебаться в пределах; 3. тянуться, распространяться
57. specification n 1. спецификация, инструкция; 2. подробность
specify v 1. точно определять; 2. давать спецификацию
specific a 1. характерный; 2. точный; 3. удельный
58. stringent a строгай, точный
59. refinement n 1. усовершенствование; 2. очистка
refine v 1. совершенствовать; 2. очищать
refined a очищенный
60. inherently adv по существу; по своей природе
inherent a присущий, свойственный
inherit v унаследовать
61. opportunity n возможность

62. explicit a: to be explicit зд. ясно проявиться

63. conventional a 1. общепринятый; 2. стандартный; 3. обычный

64. sufficient a достаточный

sufficiently adv достаточно

Проверьте, как вы запомнили слова.

(1 -10) the feature of the gate; a feature size; to exhibit the pattern; to exhibit the performance; vulnerability to the response; to process the data; the arrangement of the processor; the availability of chips; to enhance the speed; time delay, a significant prediction; to determine the capability; the level of development

(11 — 20) the net effect; to appreciate the feature; an appreciable extension; to contribute efforts; an arrangement suitable for the purpose; a mode in common use; a contribution to the processing

(21 — 30) to concern the events occurred; to turn full time to research; to amplify the sensitivity; to trace the operation

(31 - 40) to affect the response rate; to add some points; to achieve the metal purity, the perfection of the rectification; to witness the event; to gain similarity, to be attributable to the emergency

(41 — 50) a durable mark; to act as a mask; to permit the size shrink

(51 - 64) an insulator coating of a conductor; to predict detrimental effect; to refer to a conventional state; sufficient purity

Задания к Основному тексту.

2.11. С целью проверки понимания первой части (I) Основного текста:

1. Найдите в тексте английские эквиваленты следующих речевых отрезкок

1. постоянное уменьшение размеров ИС; 2. новые материалы имеют такие характеристики, как; 3. усовершенствования, достигнутые в технологии; 4. размеры транзистора; 5. задержки по времени, связанные с; 6. определение характеристик схемы; 7. более высокий уровень интеграции позволяет увеличить; 8. довольно значительная задержка по времени; 9. конструкция любого устройства; 10. большой вклад в изучение; 11. исследование процессов, происходящих в p-n переходах; 12. чрезвычайная важность полупроводниковых материалов; 13. посвятили все свое время исследованию полупроводников; 14. определить химическую чистоту

2. Запишите кратко с помощью английских глаголов-сказуемых содержание первой части, например: has focused attention on new materials; have allowed integration of more devices on the same chip, etc.

3. Кратко изложите на английском языке содержание первой части, используя следующие выражения:

1. Extensive effort has been devoted to the design of...; 2. The effort continues in the direction of...; 3. It is expected that....

2.12. Устно переведите вторую часть (П) Основного текста.

2.13. Письменно в виде аннотации изложите по-русски содержание второй части (П) Основного текста.

2.14. Изложите кратко содержание Основного текста на английском языке. Используйте следующие клише:

1. The review surveys ...; 2. Advances are described ...; 3. There is no reason to believe ...; 4. The conclusion of the study is as follows...

Проверьте, сможете ли вы перевести.

2.15. Переведите, учитывая особенности перевода правых определений:

1) 1. complex electronic systems to be installed; 2. new materials to exhibit proper characteristics; 3. dimensions of a MOS transistor to enhance the speed; 4. materials to be tailored for new structures are

2) 1. chips designed for use in military electronic systems are; 2. a semiconductor amplifier proposed by W.Shockley was patented; 3. transistor action occurring within a single

grain of polycrystalline material shows; 4. transistor operation affected by electronic trap has; 5. chemical purity influenced by the degree of crystal perfection provides; 6. uniformity of structure relied upon depends; 7. a wafer of silicon spoken about is heated

3) 1. fundamental factors influencing resistor performance are; 2. a material having a negative temperature coefficient is used; 3. copper wire containing the oxide layers is; 4. a complete circuit typically consisting of 10 to 20 transistors causes

4) 1. the way of developing materials; 2. an attempt of using impurities; 3. the variety of handling the wafer; 4. the capability of amplifying the current

5) 1. contributions capable to improve are; 2. new chips commercially available are; 3. oxygen concentration influences; 4. insulator coating suitable in the case is

6) 1. the detrimental effects in question can be reduced; 2. a mask under consideration is attributable to the properties; 3. conventional p-n diodes in operation offer; 4. the purity in existence makes

2.16. Переведите, определив значения слов one, ones, опираясь на контекст.

1. One of the problems has been solved with the help of electronics in space communication. 2. Electronics is not a static field of study, but a dynamic one. 3. One should know gallium arsenide has a much higher electron mobility than germanium and silicon.

Учитесь читать и переводить.

Текст 2.3. Прочитайте текст. Кратко расскажите по-русски или по-английски о недостатках и преимуществах использования арсенида галлия.

Semiconductors as Materials

A semiconductor is a material having a resistivity in the range between conductors and insulators and having a negative temperature coefficient. The conductivity increases not only with temperature but is also affected very considerably by the presence of impurities in the crystal lattice.

Types of semiconductor material commonly used are ele- ments falling into group IV of the Periodic Table, such as silicon or germanium. The donor and acceptor impurities are group V and group Ш elements, respectively, differing in valency by only one electron.

Certain compounds such as gallium arsenide (Symbol: GaAs) which has a total of eight valence electrons, also make excellent semiconductors.

GaAs is a direct-gap HI-V semiconductor that has a relatively large band gap and high carrier mobility. The relatively high carrier mobility allows the semiconductor to be used for high-speed applications and because of the large energy gap it has a high resistivity that allows easier isolation between different areas of the crystal. The conduction band is a two-state conduction band; some electrons therefore are "hot" electrons, i.e. they have small effective mass and higher velocity, this resulting in the Gunn effect.

GaAs is difficult to work since diffusion of impurities into the material is extremely difficult. Epitaxy, or ion implantation must therefore be used to produce areas of different conductivity type. The main uses for gallium arsenide have been as microwave devices, such as Gunn diodes or IMPATT diodes, but lately it has been used as a MESFET (a GaAs junction field-effect transistor) for high speed logic circuits.

Текст 2.4. Просмотрите текст. Сравните данную информацию с информацией текста 2.3. Какая новая информация сообщается в данном тексте? Значения выделенных слов вы сможете понять из контекста.

Speedier Semiconductor Chips

The ongoing microelectronics revolution was ushered in some 30 years ago by the introduction of silicon-based semiconductor chips. The circuits speeds in some advanced computer equipment are now approaching the theoretical Emits of silicon, and for many years scientists have been experimenting with faster-working alternative materials. Harris Microwave Semiconductor, of Milpitas, Calif., recently introduced two digital integrated circuits made from one exotic alternative to silicon: gallium arsenide.

Electronic chips made from gallium arsenide have been available in the past, but usually only on a prototype basis. The new Harris chips, both of which are designed for use in sophisticated telecommunication equipment and military electronic systems are the first commercially available off-the-shelf gallium-arsenide IC chips. The manufacturer says they work five tunes faster than the speediest of today's silicon-based counterparts.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ (ЗАНЯТИЕ ВТОРОЕ)

Проверьте домашнее задание.

2.17. Ответьте на следующие вопросы:

1. What new possibilities did the advent of the transistor open? 2. What are semiconductors? What are the mam properties of the semiconductors? 3. What is the operation of a semiconductor based on? 4. What are donors? What are acceptors? 5. What makes silicon an indispensable material in microelectronics? 6. What are attractive characteristics of GaAs? In what way can it compete with germanium? with silicon?

2.18. Изложите содержание Основного текста в виде аннотации. Используйте следующие слова и словосочетания:

1.... have been developed; 2.... make it possible (to do) ...; 3.... has allowed the further reduction ...; 4.... the need was clearly evident for...; 5.... are discussed...

2.19. Назовите синонимы следующих слов (вы можете найти их в Основном тексте):

1) 1. show, present v, 2. unsafe, weak a, 3. increase, intensify v, 4. keep back, slow v, 5. connect, relate v, 6. understand, recognize v, 7. invent, create v, 8. give, supply v, 9. happen, take place v

2) 1. take, receive v, 2. influence v, 3. grow, increase v, 4. allow v, 5. cover v, 6. support, keep in condition v, 7. dean, purify v

2.20. Переведите предложейия. Учитывайте особенности перевода правых определений:

1. From the information available in the literature, CMOS chip under consideration demands substantial design efforts. 2. Time delays associated with interconnections made of different materials have been considered. 3. The proper choice of the material within the constraints (ограничение) placed by the fabrication technology existing can result in minimization of the RC delay time. 4. The area occupied by a MOS transistor can be made smaller by shortening its channel width and length leading to a faster device. 5. Smaller dimensions, larger chip size, and circuit innovations in question all contribute to the progress of integration and the generation of a larger number of components on a single chip. 6. The long distance line voltage drop will increase with scaling mentioned above. 7. Polysilicon to be used meets all of the requirements addressed above.

Учитесь читать и переводить.

Текст 2.5. Прочитайте текст. Скажите, что в нем говорится о: а) junction transistor; б) integration. Озаглавьте текст.

The Erst transistor developed was the junction transistor. Nearly all transistors today are classed as junction transistors.

Through the years there were developed new types of junction transistors that performed better and were easier to construct. When first introduced the junction transistor was not called that; it was the "cat's whisker" used in the first radia receivers in the 1920s. Shockley and his crew resurrected (возродить) it, a mere imposing name sounded much more scientific. The junction transistor of 1948 was further modernized in 1951, with the development of the "grown" transistor. The technology for manufacturing transistors steadily improved until, in 1959, the first integrated circuit was produced — the first circuit-on-a-chip.

The integrated circuit constituted another major step in the growth of computer technology. Until 1959 the fundamental logical components of digital computers were the individual electrical switches, first in the form of relays, then vacuum tubes, then transistors.

In the vacuum tubes and relay stages, additional discrete components such as resistors, inductors and capacitors were required in order to make the whole system work. These components were about the same size as packaged transistors. Integrated circuit technology permitted the elimination of some of these components and "integration" of most of the others on the same chip of semiconductor that contains the transistor. Thus the basic logic element—the switch, or "flip-flop", which required two separate transistors and some resistors and capacitors in the early 1950s, could be packaged into a single small unit in 1960. That unit was half the size of a pea.

The chip was a crucial (важный) development in the accelerating pace of computer technology. With integrated circuit technology, it became possible to jam (зд. размещать) more and more elements into a single chip. Entire assemblies of parts could be manufactured in the same time that it previously took to make a single part. Clearly, the cost of providing a particular computing function decreased proportionally. As the number of components on an integrated circuit grew from a few to hundreds, then thousands, the term for the chip changed to microcircuit.

Текст 2.6. Переведите текст устно без словаря. Значения выделенных слов вы сможете понять из контекста.

The two elements we can now concentrate on, as by far the most important semiconductors, are silicon and germanium. Silicon is one of the most plentifiil elements in the world, but occurs in chemical compound such as sand (silica), from which it is difficult to extract pure silicon. The element can be isolated by the reduction of silica in an arc furnace. It then contains small quantities of calcium, iron, aluminium, boron and phosphorus as principle impurities. Alternatively, silicon can be prepared by the pyrplytic reduction of silicon tetrachloride and in this way the material can be obtained free from analytically detectable quantities of boron and phosphorus.

Germanium is comparatively rare but it is rather easier to refine. It should perhaps be mentioned that the list of semiconductors given is not confined to elements; increasing attention is being paid to semiconductor compounds such as indium antimonide and other compounds of group Ш with group V elements.

Текст 2.7. Переведите текст письменно со словарем. Время перевода —15 минут.

GaAs MESFETs Research

More than 40 years have passed since the bipolar transistor was invented by Shockley in 1948. Bipolar technology has highly matured today, and the structure of Si bipolar transistor has been improved almost to its physical limits. The upper frequency limit of its practical application is considered to be 4 GHz regardless of advances in technology.

In 1966, C.A.Mead demonstrated the possibility of a transistor with a very high cut-off frequency employing a GaAs field effect transistor with a Schottky barrier gate. Since then, GaAs MESFET research and development efforts have been made in many laboratories around the world. The main purpose of the development of GaAs MESFET is to obtain three-terminal microwave semiconductor devices which can be used to develop microwave amplifiers to replace the parametric low noise amplifiers and the travelling wave tube power amplifiers.

In the last several years, GaAs MESFETs have made remarkable progress in both low noise GaAs MESFET amplifiers, resulting in a substantial reduction in the cost of microwave communication systems. High power GaAs MESFETs replaced some TWTs, guaranteeing a much longer lifetime and a smaller size than the TWT.

Текст 2.8. Прочитайте текст. Какую новую информацию вы узнали об использовании материалов? Значения выделенных слов вы сможете понять из контекста.

Materials for Multilayer Interconnections

As device dimensions are becoming increasingly smaller severe requirements are being imposed on the electrode material. The basic demand is conductivity because it can substantially improve the resistances and delay times of the electrical interconnections lines used for VLIC structures.

Historically, metals like aluminum and gold have been used in bipolar and MOS IC's.

With the advent of silicon-gate MOS technology, polysilicon has been extensively used to form gate electrodes and interconnections. Refractory metals such as tungsten

(W), molybdenum (Mo), titanium (Ti), and tantalum (Ta) and their silicides are receiving increased attention as a replacement/compliment of polysilicon.

Silicides of W, Mo and Ta have reasonably good compatibility with the IC fabrication technology. They have fairly high conductivity, they can withstand all of the chemicals normally encountered during the fabrication process.

Определите контекстуальное значение выделенных слов.

2.21. Переведите, обращая внимание на контекстуальное значение выделенных слов:

1) 1. Aluminum is the most problematic material to be used for metallization in maintaining contact stability. 2. A lower resistivity is required for maintaining circuit performance. 3. Use of this self-test technique greatly simplifies field maintenance. 4. For storage and retrieval of data in the bubble-memory use is made of a group of registers and counters for accurately maintaining the position of data. 5. Any system must be designed to require less maintenance. 6. Preventive maintenance is necessary.

2) 1. This entails turning one of the file processors into an input/output unit. 2. Today, plants depend on carbon dioxide and water to survive. In turn, they produce organic matter. 3. Water can turn to a solid. 4. Let us now turn to ceramics. 5. At the turn of the 18th century nobody knew of semiconductors.

3) 1. Sometimes the performance of the circuits can suffer from technological advancement. 2. The systematic approach can anticipate the problems that will arise in future VLSI. 3. The average wire length can be estimated by a very useful statistical formula.

Проверьте, знаете ли вы следующие термины.

2.22. Назовите данные термины по-английски. Вы можете найти эти термины в Основном тексте:

1. интегральный усилитель, усилитель считывания, полупроводниковый усилитель, усилитель на ПЗС; 2. клейкое покрытие, проводящее покрытие, нанесение покрытия методом погружения, покрытие, нанесенное напылением, связующий подслой; 3. проектирование кристалла, блочная конструкция, проектирование схемы, топологическое проектирование, оперативное проектирование схем, проектирование с выбором схем; 4. акцепторная примесь, легирующая примесь, примесь, наносимая на поверхность полупроводника; 5. усиление по току, инверсный коэффициент усиления, нагрузочная способность логической ИС, но минальный коэффициент усиления; 6. зазор между контактами, ширина запрещенной зоны, запрещенная зона с прямыми переходами, микрозазор, запирающий слой, герметизирующий слой, слой, стойкий к травлению, напыленный слой, исходный слой, многослойная пленка

Учитесь говорить.

Текст 2.9. Прочитайте текст и кратко изложите его содержание на английском языке. Используйте следующие выражения:

1. As you can see from the title the text is devoted to...; 2. The problem arose...; 3. According to the text...; 4. Experiments paved the way to ...; 5. Experiments proved ...; 6. Research has shown that...; 7.I find the text rather/very...; 8. I've learnt a lot...

Made in Space

Numerous experiments carried out at the Soviet orbital stations have paved the way to the development of methods and means of industrial production in space.

In recent years active research has been going on in one of the fields of space industrialization —space material study and production of new materials of better quality on board the spacecraft, ranging from semiconductors for microelectronics to unique and more efficient medicines for the treatment of quite a number of diseases (болезнь).

Conditions on board a space vehicle orbiting the earth drastically differ from those on its surface. However, all of these conditions can be simulated on Earth, except for one — prolonged weightlessness.

What can weightlessness be used for? Many well-known physical processes proceed differently due to absence of weight. In case of melts of metals, glasses, or semiconductors, they can be cooled down to the solidification point even in space and then brought back to Earth. Such materials will possess quite unusual properties.

There is no gravitation convection, i.e. movements of gases or liquids caused by difference of temperature in space. Manufacturers of semiconductors know only too well that convection is to blame for the various faults in semiconductors. The technical specialists started their experiments aimed at proving the advantages of the zero-g state for the production of certain materials. In the Soviet Union all orbital stations from Salyut 5 onwards were used for that purpose, as well as automatic space probes and high-altitude rockets. Since 1976, over 600 technological experiments have been staged in the Soviet Union on board its manned and unmanned space vehicles. An impressive number of similar experiments have also been carried out by scientists in other countries.

The experiments proved that scientists were right. Many of the properties of the materials obtained in the zero-g conditions were much better pronounced as compared with those of the specimens produced on Earth.

At the same time, test runs of the installations of the next generation developed for the small-scale industrial production in space have started. One such installation, Korund, has already been tested successfully on board the Salyut station. It has been designed to grow monocrystalline semiconductors possessing unique properties.

In order to launch full-scale industrial production of monocrystalline semiconductors, bioactive preparations and other substances it is not enough just to commission new-generation technology installations. Special space vehicles will also be needed. Research has shown that the acceleration rate on board these vehicles must be reduced to the minimum. Power plants of the capacity of dozens of kw, and later, of hundreds of kw are needed.

2.23. Подготовьте сообщения по следующим темам:

1. Intrinsic semiconductor properties. 2. Contributions to the study of semiconductor physics. 3. Silicon and its dominant role as a material for microelectronic circuits. 4. New materials and their potentials.

2.24. Докажите правильность или ошибочность следующих суждений:

1. The silicon dioxide is particularly important in the fabrication of integrated circuits. 2. Oxygen influences many silicon wafer properties. 3. Gallium arsenide has a much lower electron mobility than germanium and silicon.

При доказательстве используйте следующие выражения:

1. That's just the point... I can also add...; 2.I don't agree with it... The point is that...

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ВТОРОГО ЗАНЯТИЯ)

Учитесь читать.

Текст 2.10. Прочитайте текст и укажите факторы, влияющие на качество резиста. Значения выделенных слов вы сможете понять из контекста.

Photoresists

Photoresists are high-sensitive materials used to generate etched patterns in substrates. The quality of the etched images depends upon the success of every step in the process, and the image flaws may be due to resist or nonresist imperfections, or to conditions which underline resist performance. Some fundamental factors influencing resist performance include adherence coating thickness, heat treatment, and resist response to various energy sources. Let us start with adherence.

A strong bond between photoresist and substrate is essential to minimize dimensional changes during development and undercutting or loss of adherence during etching. The intimate contact between resist and substrate required for strong adhesion can be inhibited by surface impurities or resist components. Zones of weakness can be created by surface contaminants such as dust, oil, absorbed gases (particularly absorbed water), dopant ions, or monolayers of previous resist coatings. Removal of obvious visible impurities such as grease, fingerprints, or dust can give an apparently clean surface, but contamination is often insidious (опасный) because it is invisible. Weakly adsorbed layers of tobacco smoke, water vapor, vacuum pump vapors, or nonstripped resist components may be present, even though difficult to detect. Condensing one's breath on the surface or placing the wafers on a cold plate can sometimes reveal an adsorbed pattern on unetched wafers after resist stripping.

Текст 2.11. Прочитайте текст и сделайте аннотацию на английском языке. Используйте следующие клише:

1. ... deals with; 2. ... is largely as a result of; 3. ... is discussed; 4. ... offers properties; 5. to sum up ...

Ceramic-to-Metal Seals

Ceramic-to-metal seals are a natural extension of the state-of-the-art where adverse temperature, shock and vibration conditions prevail. Alumina ceramics are widely used for high-performance electronic applications because of their excellent properties and moderate costs. Beryllia ceramic-to-metal seals are available but generally limited to where high heat transfer is needed.

The alumina ceramic family offers a combination of desirable properties for ceramic-to-metal seals:

Electrical — high resistance, low losses, and high dielectric strength.

Mechanical — high compressive, tensile, and flexible strength, high impact strength and high hardness.

Thermal — intermediate thermal expansion coefficient that enables sealing to many metals and matching components, good thermal conductivity, good thermal shock resistance, and good high temperature properties.

Chemical —extremely stable and surface capable of withstanding harsh chemicals and cleaning procedures.

Текст 2.12. Прочитайте текст. Изложите на английском языке основные требования, предъявляемые к материалам.

Materials Requirements

The following are the general requirements for a material for interconnects and contacts: high electrical conductance, low ohmic contact resistance, electromigration, stable contacts (with silicon and final metallization), corrosion and oxidation resistance, high temperature stability, strong adhesion characteristics.

One of the primary considerations is to obtain a material with high electrical conductivity and low ohmic contact resistance. It should also have good electromigration resistance and be stable when in contact with silicon and/or oxide and the final metallization.

These parameters must be maintained throughout the high temperatures encountered during processing; i.e., to maintain their metallurgical integrity. This requires that the melting point of the materials used be much higher than conventional process temperatures.

2.25. Дайте классификацию пленочных материалов. Используйте схему:

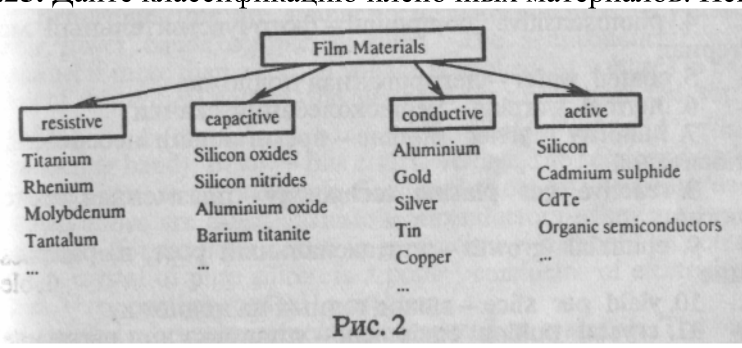


Рис. 2

2.26. Сравните несколько материалов, используемых в микроэлектронике, по их физическим, электрическим, оптическим и другим свойствам.

2.27. Подготовьте схему (на английском языке), показывающую сходство и различие материалов, используемых в микроэлектронике.

РАЗДЕЛ ТРЕТИЙ

Основной текст: Problems in Microelectronic Circuit Technology.

Грамматические явления: Типы сказуемого. Способы их выявления в тексте. Их перевод.

Лексические явления: Контекстуальное значение слов: due, appear, advance. Перевод слов с префиксами: in-, out-, en-, inter-.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ
(ЗАНЯТИЕ ПЕРВОЕ)

Проверьте, знаете ли вы следующие слова.

1) insulator n, generate v, region n, protective a, collector n, planar a, regular a, ordinary a, mobile a, photosensitive a, attack v, base n, formv, fraction n, variety n, thermal a

2) a number of, consider v, bind v, available a, band n, similar a, requirement n, describe v, lead v, surround v, state n, create v, pass v, passage n, surface n, frequency n, realize v, define v, select v, software n, apply v, applicable a, yield n, discharge n, dimension n, believe v, layout n, goal n, precise a, employ v

Ознакомьтесь с терминами Основного текста.

1. valence band — валентная зона, связь
2. conducting band — зона проводимости
3. delay time — время задержки
4. photosensitive compound — фоточувствительный материал
5. coated wafer — легированная подложка
6. thermal warping — термоколебания, скачки
7. minority carrier lifetime — время жизни неосновных носителей
8. reactive gas plasma technology - плазменная техно-логия
9. epitaxial growth — эпитаксиальный рост, выращивание
10. yield per slice — выход годных на подложку
11. crystal pulling equipment —установка для вытягивания кристалла
12. thermal reduction — термическое восстановление
13. chemical-vapour deposition — выращивание кристалла в парофазе
14. fine-line lithography — очень точная литография
15. fine-line resolution — высокоточная разрешающая способность

ОСНОВНОЙ ТЕКСТ

1. Переведите первую часть (I) текста в аудитории устно под руководством преподавателя.

2. Бегло прочитайте вторую часть (II) текста и кратко изложите его содержание на русском языке.

PROBLEMS IN MICROELECTRONIC CIRCUIT TECHNOLOGY

I. The manufacture of silicon microcircuits consists of a number of carefully controlled processes, all of which have to be performed to well-defined specifications.

Processing a "wafer" of silicon, a substrate on which the microelectronic circuits are made, is not a simple technological process.

In order to understand how transistors and other circuit elements can be made from silicon, it is necessary to consider the physical nature of semiconductor materials.

In a conductor current is known to be carried by electrons that are free to flow through the lattice[1] of the substance.[2]

In an insulator all the electrons are tightly[3] bound to atoms or molecules and hence[4] none are available to serve as a carrier of electric charge.

The situation in a semiconductor is intermediate[5] between the two: free charge carriers are not ordinarily present, but they can be generated with a modest expenditure[6] of energy.

Semiconductors are similar to insulators in that they have their lower bands completely filled.[7] The semiconductor will conduct if more than a certain voltage is applied. At voltages in excess of this critical voltage, the electrons are raised from the top[8] of the band 1 (the valence band) to the bottom[9] of band 2 (the conducting band). Below[10] this critical voltage, the semiconductor material acts as an insulator. Semiconductors such as that described above are called intrinsic semiconductors — they are pure materials (for example silicon or germanium). It should be noted that a crystal of pure silicon is a poor[11] conductor of electricity. Thus,[12] conductivity poses[13] a problem.

Several other requirements are imposed on materials. The basic demand appears to be conductivity because it can substantially improve[14] the resistance and delay times for VLSI. The improvement of conductivity has been made in several ways. Most semiconductor devices are known to be made by introducing controlled numbers of impurity atoms into a crystal, the process called doping.

Two independent lines of development are considered to lead to microscopic technique that produced the present integrated circuits. One involves the semiconductor technology; the other is a film technology.

Let us consider the former[15] one first. To impreve the semiconductor crystal the impurities known as dopants are added to the silicon to produce a special type of conductivity, characterized by either positive (p-type) charge carriers or negative (n-type) ones. The dopants are diffused[16] into semiconductor crystals at high temperature. In the furnace the crystals are surrounded by vapour containing atoms of the desired dopant. These atoms enter the crystal by substituting[17] for the semiconductor atoms at regular sites[18] in the crystal lattice and move into the interior[19] of the crystal by jumping from one site to an adjacent[20] vacancy.[21]

Silicon crystals may be doped with different elements. Suppose silicon is doped with boron. Each atom inserted[22] in the silicon lattice creates a deficiency[23] of one electron, a state that is called a hole. A hole also remains associated with an impurity atom under ordinary circumstances[24] but can become mobile in response to an applied voltage. The hole is not a real particle, of course, but merely[25] the absence of an electron at a position where one would be found in a pure lattice of silicon atoms. Nevertheless[26] the hole has a positive electric charge and can carry electric current. The hole moves through the lattice in much the same way that the bubble[27] moves through a liquid medium. An adjacent atom transfers[28] an electron to the impurity atom, "filling" the hole there but creating a new one in its own cloud of electrons; the process is then repeated, so that the hole is passed along from atom to atom.

Silicon doped with phosphorus or another pentavalent element is called an n-type semiconductor. Doping with boron or another trivalent element gives rise to ap-type semiconductor.

Impurities may be introduced by the diffusion process. At each diffusion step[29] in which n -type or p-type regions are to be created in certain areas, the adjacent areas are protected[30] by surface layer of silicon dioxide, which effectively blocks the passage of impurity atoms. This protective layer is created very simply by exposing[31] the silicon wafer at high temperature to an oxidizing atmosphere. The silicon dioxide is then etched[32] away in conformity with a sequence[33] of masks that accurately delineates[34] multiplicity[35] of n-type and p-type regions.

To define the microscopic regions that are exposed to diffusion in various stages[36] of the process, extremely precise[37] photolithographic procedures[38] have been developed. The surface of the silicon dioxide is coated with a photosensitive organic compound that polymerizes wherever it is struck by ultraviolet radiation and that can be dissolved[39] and washed away everywhere else. By the use of a high-resolution photographic mask the desired configurations can thus be transferred to the coated wafer. In areas where the mask prevents[40] the ultraviolet radiation from reaching the organic coating the coating is removed. An etching acid[41] can then attack the silicon dioxide layer and leave the underlying silicon exposed to diffusion.

A transistor can be made by adding a third doped region to a diode so that, for example, ap-type region is said to be sandwiched between two n-type regions. One of the n-doped areas is called the emitter and the other, the collector; the p-region between them is the base.

The transistor described is called an npn transistor. There may be pnp transistors. The terms[42] are likely to denote[43] the sequence of doped regions in the silicon.

The first transistor structures were formed by alloying[44] or diffusion in bulk[45] single-crystal Ge or Si, but with the development of "planar technology" in the early 1960s the possibility of forming high frequency transistors and integrated circuits using epitaxial semiconductor films was realized.

The success of silicon in microelectronics is believed to be largely attributed to excellent properties of SiO_2 interface[46] and ease of thermal oxidation of silicon.

The recent years have seen considerable interest in the subject of oxygen and its precipitates[47] in silicon. It has now been established[48] that their presence can have a variety of effects, harmful[49] as well as beneficial. Oxygen concentration is known to influence many silicon wafer properties, such as wafer strength, resistance to thermal warping, minority carrier lifetime, and instability in resistivity. Oxidation is widely used to create insulating areas. However many phenomena happen not to be understood at present.

An important aspect of the oxidation process is its low cost. Several hundred wafers can be oxidized simultaneously in a single operation.

Reactive gas plasma technology is reported to be presently in wide-spread use in the semiconductor industry. This technology is being applied to the deposition and removal[50] of selected materials during the manufacture of semiconductor devices.

Contributing greatly to the manufacturing technique is a unique crystal forming method known as epitaxial growth.

Epitaxial growth in combination with oxide masking and diffusion has given the device designer extremely flexible tools[51] for making an almost limitless variety of structures.

After 1964 epitaxial growth remains an important technique in semiconductor device fabrication and the demand for improved

device yield per slice,[52] still higher device operating frequencies and more sophisticated[53] device structures has needed continuing innovation[54] and development.

Advances[55] in silicon crystal growth technology have encouraged advances in the automation of crystal growing equipment. Crystal pulling[56] equipment now available uses computer software to control all the growing parameters. Preprogrammed process changes are used to tailor crystal characteristics.

II. Let us see what a film technique is like. Even before the invention of the transistor the electronic industry had studied the properties of thin film of metallic and insulating materials. Such films range in thickness from a fraction of a micron, or less than a wavelength of light, to several microns.

The techniques for the deposition[57] of thin films are numerous and include the following methods: evaporation, sputtering,[58] anodization, radiation, induced "cracking" or polymerization, chemical reduction, thermal reduction of oxidation and electrophoresis. The first three are the major techniques used in integrated thin film circuit construction and are also applicable to silicon integrated circuitry and device work. These methods singly or in combination enable[59] a variety of resistive, insulating and constructive materials to be laid down onto a suitable substrate.

The two most important processes for the deposition of thin films are chemical-vapour deposition and evaporation. The film technology has proved to provide precise dimensions.

In the fabrication of a typical large-scale integrated circuit there are more thin-film steps than diffusion steps. Therefore thin-film technology is probably more critical to the overall yield and performance of the circuit than the diffusion and oxidation steps are. A thin film happens even to be employed to select the areas on a wafer that are to be oxidized.

For VLSI structures several other requirements are imposed on interconnection materials by the fabrication technology.

The deposition of layers is followed by shaping operations, such as etching, to form the required outlines.[60] Alternatively, the film can be deposited through a mask onto the substrate to define the outlines directly. In this way many identical thin-film devices can be made on a single sheet of material, which then are cut apart to yield individual devices.

Plasma etching, which is expected to play an important role in manufacture of semiconductor and other devices requiring fine-line lithography, involves the use of a glow discharge to generate reactive species[61] from relatively inert molecular gases. These reactive species combine chemically with certain solid materials to form volatile[62] compounds which are then removed by vacuum pumping system.

This plasma-etching process has been shown to have important advantages in terms of cost, cleanliness, fine-line resolution, and potential for production line automation.

Additionally, the inside of a wafer-fabrication must be extremely clean and orderly: a single particle happens to cause a defect that will result in the malfunction of a circuit. The larger the die,[63] the greater the chance for a defect.

The structure of an integrated circuit is sure to be complex both in the topology of its surface and in its internal composition. Each element of such a device has intricate[64] three-dimensional architecture that must be reproduced exactly in every circuit. The structure is made up of many layers, each of which is a detailed pattern. Some of the layers lie within the silicon wafer and others are stacked[65] on the top. The manufacturing process consists in forming the sequence of layers precisely in accordance with the plan of the circuit designer.

Nowadays much of the procedure by which ICs are transformed from the conception of the circuit designer to a physical reality is done with the aid[66] of computers. In the first stage of the development of new microelectronic circuits the designers themselves used to work at specifying the functional characteristics of the device. They also selected the processing steps that will be required to manufacture it. The process was difficult and not always exact. A computer can simulate[67] the operations of the circuit. Besides, computer simulation is less expensive than assembling a "bread-board" (макет) circuit made up of discrete circuit elements; it is also more accurate.

The layout is known to specify the pattern of each layer of the IC. The goal of the layout is to achieve the desired function of each circuit in the smallest possible space. At present much of the preliminary (предварительный) work is done with the aid of computers. The final layout is also made with that of a computer.

Increasing interest in submicron layer now poses new problems. New developments in materials are believed to be due[68] to new manufacturing forms and vice versa.

Integrated circuit technology is evolving so rapid that even a period as short as six months can produce a significant change.

Проверьте, как вы запомнили слова.

3.1. Переведите следующие слова, исходя из значений, приведенных в скобках:

1. process v (обрабатывать), processing я, processor «; 2. substance п (вещество), substantially adv, substantiate v; 3. intermediate в (промежуточный), intermediately adv, medium n; 4. expenditure п (расход, трата), expend v, expense n, expensive a; 5. similar a (одинаковый), similarity n, simulate v; 6. add v (прибавлять), additional a, addition n, adder n; 7. vapour n (пар), vaporize v, vaporous a, vaporizer n; 8. transfer v (передавать), transferkable a, transference n; 9. precise a (точный), precisely adv, precision n; 10. dissolve v (растворять), dissolvable a, dissolvent n, solution n; 11. prevent v (мешать), prevention n, preventive a; 12. harmful a (вредный), harm n, harmless a; 13. advance v (двигаться вперед), advance n, advanced a; 14. establish v (устанавливать), establishment n; 15. deposition n (осадок), deposit v, pose v, impose v; 16. volatile a (летучий), volatility n, volatilize v; 17. term n (термин), terminal n, terminate v, in terms; 18. specify v (определять), specification n, specific a; 19. major a (главный), majority n

3.2. Определите значения английских слов, исходя из контекста:

1. строго defined параметры; 2. processing of металла может быть холодной; 3.

требуется небольшая expenditure энергии; 4. в некоторых проявлениях полупроводники similar to диэлектрикам; 5. чистый кремний — poor проводник; 6. атомы примеси substitute атомы полупроводника; 7. проводимость poses трудности; 8. иногда нужно to add примесь к полупроводникам; 9. применение кремния is attributed to прекрасным качествам; 10. сейчас it has been established, что присутствие кислорода может оказывать harmful и beneficial эффекты; 11. окисление под давлением offers метод выращивания окислов кремния; 12. the mask prevents от попадания ультрафиолетового излучения на покрытие

3.3. Переведите следующие слова. Обратите внимание на значения префиксов in- —внутри, в-; out- —вне-; en— участвовать; inter- — взаимодействовать.

in-: inclose v, input n, inbuild v, inside a out-: outbalance v, output n, outbreak n, outdated a en-: enable v, enact v, encircle v, enclose v inter-: interaction n, interchange n, intercourse n

Обсудите содержание текста.

3.4. Просмотрите еще раз первую часть (I) Основного текста. Ответьте на вопросы, используя информацию текста.

1. What could you say about the manufacture of silicon micro-circuits? 2. What is the physical nature of semiconductor materials? 3. When does the semiconductor material act as an insulator? 4. When does the semiconductor conduct? 5. What could you say about a crystal of pure silicon? 6. Why is conductivity one of the basic requirements imposed on materials? 7. Can you name one of the ways to improve conductivity? 8. What do we call impurities added to silicon? 9. What is a hole like? 10. How do holes behave in the p-type region? 11. What could you say about oxidation? 12. Why do we call epitaxial growth of crystals unique?

3.5. Обобщите информацию, данную в тексте (I часть) на английском или русском языке. Что вы узнали о полупроводниках, их проводимости, способах введения примесей, способах травления, пленках, окислении?

3.6. Просмотрите вторую часть (II) Основного текста. Сообщите, что вы узнали о:

1. the properties of thin films of metallic and insulating materials; 2. the techniques for the deposition of thin films; 3. the two most important processes for the deposition of thin films; 4. the deposition of layers; 5. plasma etching; 6. the layers within the silicon wafer; 7. new developments in materials

Проверьте, как вы умеете опознавать и переводить формы сказуемого.

3.7. Переведите речевые отрезки. Обратите внимание на перевод сказуемого V^1, первым компонентом которого является личная форма глагола to be:

1. the discovery is leading to; 2. the discovery is able to lead to; 3. the discovery is certain to lead to; 4. the discovery is expected to lead to; 5. the discovery is likely to lead to; 6. the discovery is supposed to lead to; 7. the discovery is to lead to; 8. the discovery is led with; 9. the discovery is of value; 10. the discovery is due to; 11. the discovery is critical; 12. the discovery is particularly important in; 13. the discovery is sure to lead to; 14. the discovery is presently in wide-spread use; 15. the discovery is a readily apparent means; 16. the discovery is being applied to; 17. the objective is to discover

3.8. Переведите речевые отрезки. Обратите внимание на перевод сказуемого V^1, первым компонентом которого является личная форма глагола to have:

1. the improvement has a reason; 2. the improvement has influenced; 3. the improvement has been influenced; 4. the improvement has been supposed to influence; 5. the improvement has to be introduced; 6. we have studied the emission properties of gas plasma; 7. we have to study the properties of; 8. the properties have been studied

3.9. Переведите речевые отрезки. Обратите внимание на их смысловое различие, зависящее от формы глагола:

Что делает N^1?	Какому действию подвергается N^1?
1. the improvement requires	the improvement is required

2. the concept predicts	the concept is predicted
3. the effort makes	the effort is made
4. the density determines	the density is determined

3.10. Переведите речевые отрезки, учитывая форму времени сказуемого в пассивном залоге V[1]:

1. the solution is provided (was provided, has been provided, has to be provided, will be provided); 2. the unit was arranged (has been arranged, is being arranged, is to be arranged)

3.11. Переведите речевые отрезки, учитывая особенности перевода глаголов to follow, to influence, to watch в пассивном залоге:

1. the pattern is influenced (was influenced, has been influenced, has to be influenced, is to be influenced); 2. the experiment was followed (has been followed) by; 3. the packing is watched (is being watched, has been watcheв, will be watched)

3.12. Переведите, учитывая особенности перевода различных форм и типов сказуемого:

1. We are still learning how to exploit the potential of the integrated circuits. 2. Small and reliable sensing and control devices are the essential elements in complex systems. 3. The attempts to miniaturize electronic components are largely successful. 4. Testing is needed in the course of production. 5. The most striking characteristic of the microelectronics industry has been a rapid decline in cost. 6. Electronics has extended man's intellectual power. 7. Several kinds of microelectronic transistors have been developed, and for each of them families of associated circuit elements and circuit patterns have evolved. 8. The fundamental units of electronic logic are circuits called gates.

Учитесь читать.

Текст 3.1. Прочитайте текст. Скажите, что вы узнали о: self-aligning chemically selective manner; masks; process complexity; selective low pressure chemical vapour deposition (LPCVD). Прочитайте текст еще раз. Озаглавьте его.

Tungsten is of particular interest in IC technology because it can be deposited in a self-aligning (самосовмещенный) chemi cally selective manner on silicon, metals, or silicides. Its volume filling capability serves to enhance planarity, a high priority in multilevel chip designs, and because it can be deposited without additional masks, process complexity is reduced with savings in cost.

Selective low pressure chemical vapour deposition (LPCVD) of tungsten can provide diffusion and etch barriers, via fills, low resistance source/drain and gate shunts, masks for X-ray lithography and many others.

The last years have been a time of rapid progress in LPCVD tungsten technology.

Текст 3.2. Прочитайте текст. Назовите предмет описания и причину внимания к нему. Назовите перспективы его применения.

Rapid Thermal Processing

RTP is one of the exciting new wafer fabrication technologies. Its origin can be traced to the laser annealing (отжиг) research of the early 1980's, but it is only with the very recent appearance of techniques and equipment suitable for use in production that the technique has begun to attract serious attention of process engineers.

Current applications for RTP include ion implant annealing, glass reflow, silicide formation, and deposition of thin gate oxides. The RTP equipment market is expected to have one of the highest growth factors in the equipment industry, a compound annual growth rate of 36.6% over the years 1987 to 1991.

Текст 3.3. Переведите текст устно без словаря.

Laying Down Thin Film

Most often, thin-film deposition on a ceramic substrate is done in a vacuum chamber by evaporating or sputtering conductive, resistive, or dielectric material on a carefully cleaned substrate.

The vacuum prevents oxidation and allows the molecules of material being deposited to travel to the target with minimum collisions with gas molecules.

Текст 3.4. Переведите текст письменно без словаря. Значения выделенных слов вы сможете понять из контекста.

Evaporation and Sputtering

In the case of evaporation, the material to be deposited is heated by a resistive heating unit until the molecules acquire the thermal energy necessary to leave the surface at a suitable speed to ensure deposition.

Sputtering differs from evaporation in that an electrical field accelerates the positive gas ions toward a cathode that is covered with a material to be deposited. An ion striking the cathode causes a molecule to be ejected and deposited on the substrate.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ПЕРВОГО ЗАНЯТИЯ)

Изучите следующие гнезда слов и словосочетаний.

1. lattice n решетка (кристаллическая)
base-centered lattice базоцентрированная решетка
body-centered lattice объемноцентрированная решетка
face-centered lattice гранецентрированная решетка
2. substance n 1. вещество; 2. сущность
substantial a 1. существенный, важный; 2. фактический
substantially adv по существу
3. tightly adv тесно, плотно
tight a 1. плотный, компактный; 2. тесный
4. hence adv отсюда; следовательно
5. intermediate a промежуточный; средний
intermediately adv в промежуточном положении, посреди
medium n 1. среда; 2. середина; 3. средство; способ
6. expenditure n расход, трата
expend v расходовать, тратить
expense n расход
at the expense of за счет
expensive a дорогостоящий
7. fill v 1. наполнять; 2. занимать
filling n 1. наполнение; 2. набивка
filler n наполнитель
8. top n 1. верхушка; 2. высшая ступень
9. bottom n 1. низ; 2. основание, основа
10. below prp ниже
low a низкий
lower v понижать
11. poor a 1. бедный; 2. плохой
poverty n бедность
12. thus adv таким образом
13. pose v:to pose a problemзд. создавать трудности; озадачивать
position n положение, место
impose v налагать
imposing a производящий сильное впечатление
14. improve v улучшать, совершенствовать
improvement n улучшение, усовершенствование
prove v 1. доказывать; 2. оказываться
15. former с прежний, предшествующий

in former times в прежние времена
the former первый (из двух названных)
Ant. the latter последний (из двух названных)
16. diffuse v 1. распылять; 2. распространять; 3. диффундировать
diffusible a способный к диффузии
diffusion n 1. рассеивание; диффузия; 2. распространение
diffusive a диффузный
17. substitute v заменять; замещать
substitution n замена; замещение
18. site n место
19. interior a внутренний
interior n внутренняя сторона
20. adjacent a смежный, соседний
21. vacancy n 1. пустота; свободное место; 2. пробел
vacant a незанятый
22. insert v 1. вставлять; 2. включать
insert n вкладыш
insertion n 1. включение; 2. прокладка
23. deficiency n 1. недостаток; 2. отсутствие
deficient в недостаточный, неполный
efficiency n эффективность, производительность
efficient a эффективный, действенный
24. circumstance n 1. обстоятельство, случай; 2.p1 условия; 3. подробности
25. merely adv только; просто
mere a явный; порстой
26. nevertheless со все же, однако
27. bubble n 1. пузырек; 2. цилиндрический магнитный домен, ЦМД; 3. устройство на ЦМД
bubble memory ЗУ на ЦМД
28. transfer v 1. перемещать; 2. передавать
transfer n 1. перенос; 2. передача
transferable a допускающий передачу
transference n передача
29. step n 1. шаг, 2. мера; 3. ступень
step v 1. ступать; 2. понижать напряжение
30. protect v 1. защищать; 2. предохранять
protection n защита
protective в защитный; предохранительный
31. expose v 1. выставлять; 2. подвергать воздействию
exposition n 1. выставка; 2. изложение
32. etch v травить на металле
etching n травление
33. sequence n последовательность; ряд; порядок
consequence n 1. последствие; 2. вывод; 3. важность
in consequence of вследствие
consequent a 1. логически последовательный; 2. являющийся результатом consequently adv следовательно
34. delineate v устанавливать размер, очертания
delineation n 1. план; 2. описание
35. multiplicity n 1. многочисленность; 2. разнообразие; 3. сложность
multiplier n 1. множитель; 2. добавочное сопротивление
multiply v 1. увеличивать; 2. умножать

multiple a 1. многократный; 2. многожильный
36. stage n 1. фаза; период, этап; 2. ступень, стадия; 3. каскад
37. precise a точный
precisely adv точно
precision n точность
38. procedure n процесс работы; технологический процесс
proceed v 1. продолжать; 2. переходить к чему-л.
proceedings n pl труды
process v обрабатывать; производить технологическую операцию
39. dissolve v 1. растворять; 2. разлагать; 3. аннулировать
dissolvable в разложимый на части; растворимый
dissolvent n растворяющий; растворитель
solution n раствор
40. prevent у предотвращать; предохранять
preventive a предупредительный; профилактический
prevention n предотвращение
41. acid n кислота
acidify v окисляться
42. term n 1. предел; срок; 2.мат. член
terms n pl условия соглашения
in terms of 1. в виде; 2. в единицах; 3. в понятиях; 4. в функциях; 5. через
in general terms в общих чертах
term v выражать
43. denote v 1. означать; обозначать; 2. указывать
denotation n 1. точное значение; 2. обозначение
note n заметка; знак
note v замечать, делать заметку
notable a заметный
44. alloy n сплав
alloy v сплавлять
45. bulk n 1. масса, основная часть; 2. объем; 3. подложка
in bulk в целом
bulky a большой, громоздкий
46. interface n 1. взаимосвязь; взаимодействие; область взаимодействия; 2. интерфейс, устройство сопряжения, раздела; поверхность раздела
47. precipitate v 1. ускорять; 2. осаждать(ся), выпадать в осадок
precipitate n осадок
precipitation n осаждение; выпадение
48. establish v 1. устанавливать; 2. доказывать; 3. учреждать; основывать; создавать
establishment n 1. установление; создание; 2. доказательство; 3. организация; учреждение
49. harmful в вредный harm n вред
50. removal n 1. удаление, устранение; 2. смещение
remove v 1. убирать; 2. смещать
removed a удаленный; смещенный
51. tool n рабочий инструмент; орудие
52. slice n 1. тонкий слой; 2. полупроводниковая пластина, п/п; 3. кристалл (ИС); 4. секционный микропроцессор
slice v резать на тонкие слои
53. sophisticated a сложный; опытный; надуманный
sophisticated equipment сложная аппаратура
sophistication n 1. умудренность; 2. кругозор; познание; широкий научный кругозор

54. innovation n 1. нововведение, новшество в технике; 2. новаторство
55. advance n 1. продвижение; успех; 2. прогресс
advance v 1. делать успехи, продвигаться; 2. выдвигать
advanced a 1. передовой; 2. успевающий; повышенного типа
56. pull v 1. тянуть; 2. растягивать
pull n 1. тяга; 2. натяжение, растяжение; притяжение
57. deposition n осаждение
chemical vapour deposition (CVD) химическое осаждение из паровой фазы
deposit n 1. отложение, осадок; 2. месторождение, залежь; осажденный слой
58. sputtering и распыление
sputter v распылять
59. enable v 1. давать возможность; 2. делать возможным
60. outline n очертание, контур
outline v нарисовать контур
61. species n 1. вид, порода; 2. разновидность
specify v точно определять; устанавливать
specific a 1. характерный; 2. точный, определенный; 3. удельный
specification n 1. спецификация; 2. деталь, подробность
62. volatile a 1. летучий, быстро испаряющийся; 2. энергозависимый (ЗУ)
volatility n летучесть
volatilize v испаряться, улетучиваться
63. die n (pl dice) 1. матрица; 2. кристалл (ИС)
64. intricate a запутанный, сложный
65. stack v складывать, накапливать
stack n 1. масса; набор, комплект; 2. стековая память
66. aid n помощь
aids n pl средства
aid v помогать
67. simulate v 1. моделировать; 2. имитировать
simulation n моделирование
68. due to prp вследствие
due a 1. должный, надлежащий; 2. обусловленный
due to the fact благодаря факту
in due course в свое время
to be due to быть обусловленным, являться следствием

Проверьте, как вы запомнили слова.

(1 -10) the lattice of the substance, to be tightly bound, to be at an intermediate stage, to fill the gap, the top band, below the level

(11 - 20) a poor design, to pose a question, to improve the state of art, the former technique, to substitute the mode existing, the interior of the package, an adjacent substrate

(21 — 30) to insert an atom into a silicon lattice, to create deficiency of one electron, to handle the material under ordinary circumstances, efforts can merely help to carry out the program, to transfer from one state into another, to be protected by surface layers

(31 — 40) a sequence of masks, to delineate multiplicity of ntype regions, to be exposed to diffusion, at various stages of the process, very precise calculations, photolithographic procedures, to dissolve the salt, to prevent the excess

(41 — 50) an etching acid, to denote the scale, the bulk of work, the bulk of a semiconductor, to establish a new industry, harmful effects, the removal of acid traces

(51 - 60) a wafer can be sliced, to substitute by sophisticated devices, to need continuing innovations, advances in crystal growth technology, a crystal pulling equipment emerged, the deposition of thin films by sputtering, the outline of a circuit

(61 — 68) to generate new species, to yield volatile compounds, to have intricate three-

dimensional architecture, the aid of computers, to simulate operations

Задания к Основному тексту.

3.13. С целью проверки понимания первой части (I) Основного текста:

1) Запишите кратко содержание текста (I часть) с помощью предикативных групп, например:

1. consists of a number of carefully controlled processes; 2. to consider the physical nature of semiconductor materials; 3. are similar to insulators; 4. poses a problem

2) Найдите в тексте английские эквиваленты следующих речевых отрезков:

1. обработка подложки —не простой технологический процесс; 2. физическая природа полупроводников; 3. свободные носители зарядов могут возникать при минимальной затрате энергии; 4. кристалл чистого кремния —плохой проводник; 5. улучшение проводимости достигается несколькими способами; 6. к кремнию добавляются примеси, чтобы создать особый тип проводимости; 7. дырка — это отсутствие электрона; 8. примеси могут вводиться диффузией; 9. воздействуя окислителем; 10. кислород влияет на многие свойства подложки из кремния; 11. эпитаксия — выращивание кристаллов в сочетании с процессами окисления и диффузии — дает возможность создания большого количества различных структур ИС

3) Составьте план текста на английском языке. Кратко изложите в соответствии с планом содержание текста. Используйте следующие выражения:

1. This is ...; 2. It is arranged as Mows ...; 3. The first paragraph introduces ...; the second advances the idea of...; 4. In conclusion ... is given

3.14. Устно переведите вторую часть (П) Основного текста.

3.15. Письменно в виде аннотации изложите по-русски содержание второй части Основного текста.

3.16. Подготовьте 10-15 вопросов по содержанию Основного текста. Типы вопросов:

1. What is the (nature, difference, process, role, importance, etc.) of...? 2. What is referred to as ...? 3. What is used as ...? 4. Where do we use ...? 5. What role (function) do the (holes) play? 6. What makes the... necessary?

Проверьте, сможете ли вы перевести.

3.17. Переведите, учитывая особенности перевода сказуемых.

1) 1. There is a continuous demand for improved metallurgical contacts in semiconductor devices. 2. The junction becomes vulnerable to diffusion between the metal layers and silicon. 3. The tremendous interest in small device structures is presently active due to the increasing requirements for obtaining very small circuit elements. 4. The size requirements are becoming increasingly severe. 5. Today, the technology is evolving at an ever-increasing speed. 6. The selection is of primary importance. 7. Increase in the packing density and also the complexity of these devices are primarily due to scaling down of the individual cells. 8. Line width gets narrower. 9. One of the primary considerations is to obtain a material with high electrical conductivity and low ohmic contact resistance. 10. These parameters are to be maintained throughout the high temperatures. 11. The material is to have resistance to the corrosion and oxidation. 12. Films of this thickness are likely to be very difficult to deposit in a continuous manner.

2) 1. The most highly conductive film reported to date was obtained by a nietal rich concentration. 2. Films produced by sputtering both exhibited a tetragonal crystal structure. 3. The resistivity of the $MoSi_2$ film was found to be less than that of polysfficon. 4. The temperatures for recrystallization to obtain the lowest possible resistivity in effect is controlled by impurities. 5. The films used were found to be mechanically strong. 6. The film composition changed with time due to the different sputter.

3) 1. Polysilicon has been the dominant interconnect material. 2. The plasma-etching process has been shown to have important advantages in terms of cost. 3. The phosphorus concentration had no influence on the resistivity of the film. 4. The control method has only

recently been applied to the design. 5. There have been no directly comparable projects. 6. Any potential microprocessor user now has to make a choice from plenty of ICs.

3.18. Назовите, какая информация (дополнение, перечисление, сравнение, итог и т.д.) предполагается после следующих слов:

1. in addition, besides; 2. hence, thus, therefore; 3. however, yet, nevertheless; 4. further, then, now, 5. consequently, as a result; 6. similarly, in the same way, 7. to sum up, in conclusion

Учитесь читать и переводить.

Текст 3.5. Прочитайте текст и найдите ответы на поставленные вопросы:

1. What is submicron technology? 2. What is it based on? 3. Why is it not possible to use conventional optical methods to define the surface of an integrated circuit of small dimensions? 4. What are the conventional methods substituted by in submicron technology? 5. What are the advantages of submicron technology? 6. What impact will it have on production techniques? 7. Where can submicron technology be applied most effectively? 8. Does the new technology require any facility changes? Why?

Submicron Technology

Silicon is the workhorse for most integrated circuit devices. Silicon processing technologies continually change. A number of technological changes must be expected with the advent of electron beam mask-making, i.e. with the development of submicron technology to produce ultra-complex devices based upon dimensions which can no longer be fabricated with the use of visible or near visible light.

The need for submicron technology is based upon continuing pressures to improve microelectronic capabilities. The present optical methods are reaching their limits. The increasing sophistication of electronics systems continually pushes the state-of-the-art of both memory and logic circuits. Improvements in cost, speed, density and power consumption are being sought.

Submicron technology refers to the fabrication of semiconductor devices with features having masked dimensions less than one micron. Normal IC technology uses mask dimensions of about five microns. By using electron beams, it is now possible to fabricate circuits with features less than one micron. Within the next few years submicron technology will become a major factor in the production of integrated circuits.

Because of the small dimensions required, it is no longer possible to use conventional optical methods to define the surface of an integrated circuit. Even optical inspection is limited because of the small dimensions. In place of light, X-rays and electron beams are used to pattern the surface of the semiconductor wafer.

In the same manner as the electron microscope provided superior resolution over the optical microscope, electron beam technology is about to impact the integrated circuit industry. The advantage of e-beam technology is that the wavelength of electrons is substantially less than the wavelength of light. E-beam technology is accompanied by the use of X-rays. X-rays have the advantage that they travel in a straight line. X-rays do not require vacuum as do electrons, which may simplify production techniques.

The use of submicrpn technology has the same effect as increasing the size of the silicon wafer. Since the devices are smaller, the number of devices per wafer is greater. Also, since the die sizes are smaller, the loss due to a die containing a material defect is smaller. The yield percentage increases. The net effect is more good dice per wafer. As is known, one of the basic measures of semiconductor performance is the number of good dice per wafer.

Submicron technology can be used for standard IC design and processing. It can be applied to both MOS and bipolar integrated circuits including injection logic. This technology applies to very fast circuits and microwave structures.

The impact of submicron technology on the IC industry will be more significant than the impact of MOS on the semiconductor industry. A principal application impact of submicron technology will be in the areas of magnetic bubble and semiconductor memories. Although the first submicron production structures range about 64 kilobits, "million-bit chips" are possible.

The super-LSI technology appears in new products where increased complexity can still be utilized. The one-chip medium-size computer quickly becomes a reality in conjunction with its one-chip memory or, alternately, a minicomputer will tend to have everything on one chip.

The utilization of submicron technology requires a completely new facility. All aspects of mask making, inspection, and other procedures are changed.

Текст 3.6. Переведите текст письменно со словарем. Озаглавьте его. Время перевода — 7 минут.

Polysilicon has been the dominant interconnect material as it offered low threshold voltages and good stable coverage with uniform and economical deposition. Its high temperature characteristic aids in stability during annealing, after etching and implantation operations. Aluminum alloy films provide better con trol over electromigration and putting then pure aluminum and the improvement in evaporation and sputtering deposition processes give better control over the film's microstructure with better step coverage.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ
(ЗАНЯТИЕ ВТОРОЕ)

Проверьте домашнее задание.

3.19. Ответьте развернуто на следующие вопросы:

1. What is the physical nature of semiconductors? 2. How does semiconductor behave at lower than room temperatures? 3. Why is a crystal of pure silicon a poor conductor? 4. What is the difference between n-type silicon and p-type silicon? 5. What is the process of doping? 6. In what ways are the areas to be doped defined? 7. What are the main dopants? 8. What role do the holes play in the conduction process? 9. What particles are the carriers of electric current in ap-type semiconductor? 10. What is the simplest semiconductor device and how does it operate? 11. What technological processes are used in the fabrication of integrated circuits? 12. What is understood by the planar technology? 13. How are the problems of tighter control of impurity diffusion solved? 14. Which techniques are referred to as direct methods of film preparation and which of them as indirect? (Describe briefly each of the techniques used.) 15. What makes the automation of crystal growing equipment a necessity?

3.20. Обсудите традиционные технологические процессы и новые направления в технологии. При обсуждении используйте следующие выражения:

1. Processing a wafer is not a simple technological process; 2. Various methods are reviewed ...; 3. It is pointed out that ...; 4. Doping gives rise to ...; 5. ... have received increasing attention over the past years; 6. It is expected that this trend will continue ...

3.21. Дайте определения следующих терминов. Опишите, что представляет собой:

1. insulator; 2. conductor; 3. semiconductor; 4. doping; 5. dopant; 6. hole; 7. deficiency, 8. a silicon wafer; 9. mask; 10. n-type semiconductor; 11. thermal oxidation; 12. deposition; 13. sputtering

Учитесь читать и переводить.

Текст 3.7. Прочитайте текст. Составьте развернутый план. Охарактеризуйте основные операции планарной технологии. Значения выделенных слов вы сможете понять из контекста. Озаглавьте текст.

An integrated circuit is comprised of a single silicon chip containing transistors, diodes, resistors and capacitors, suitably connected to form a complete circuit. The first successful attempt to produce an integrated circuit, in 1959, made use of mesa construction, but this method is known to be quickly replaced by the use of planar techniques.

The important feature of the planar process is the deposition of a silicon dioxide layer on the top surface of the epitaxial wafer which acts as a mask against diffusion. The process involves exposing the wafer to an oxygen atmosphere at high temperature.

After the oxidation process it is necessary to etch holes in the oxide, through which diffusion can take place. The process used is similar to that employed in the manufacture of printed circuit boards. Initially the oxidized surface is coated with a thin film of photo-sensitive emulsion (photoresist). A mask is manufactured, the pattern of which defines the area to be etched, it being opaque (непрозрачный) where etching is to be performed and transparent where the oxide is to be retained. The mask is brought into contact with the wafer and exposed to ultraviolet light. The photoresist under the transparent area of the mask being subjected to the light becomes polymerized and is not affected by the trichlorethylene developer which is subsequently used to dissolve the unexposed resist. When fixed, by baking (отжиг), the remaining photoresist protects the oxide from the window where diffusion is required and, after the surface has been cleaned, the chip is ready for the first diffusion process.

For a p-type diffusion the most generally used dopant proves to be boron. This is deposited on the wafer at high temperature, and diffuses through the window into the silicon. A p -type region is thus created. The oxidization treatment is now repeated and, in this high-temperature process, the open window is sealed with an oxide layer and the base dopant is driven deeper into the silicon. A new mask is used in a second photoresist and etching stage, which opens a window for the diffusion of the emitter region.

For n -type diffusion the most generally used dopants are phosphorus and arsenic. The cycle is supposed to be repeated yet a third time. The emitter window is sealed by oxidization, the emitter dopant is driven in, and new windows are etched in the oxide layer to define the contact areas. Finally the contacts are made by the evaporation of aluminum.

In practice many devices are manufactured at the same time on a single sheet of silicon. These are separated by scribing with a diamond stylus and breaking into individual chips. They are then mounted in suitable packages which allow electrical connections to be readily made and power, dissipated as heat, to escape.

It is necessary to be able to electrically isolate individual devices from each other. This is done by surrounding each component with material of opposite polarity and reverse biasing the semiconductor junction so formed.

Текст 3.8. Переведите текст письменно без словаря. Время перевода —12 минут. Значения выделенных слов вы сможете понять из контекста.

High Pressure Oxidation of Silicon

Silicon oxidation has been a fundamental process of silicon device technology for a long time. However, an understanding of oxidation methods and the phenomena involved is far from complete. An oxidation method that has received increased attention over the last few years is a high pressure oxidation method. This method is known to offer a practical means for thermally growing silicon oxides at lower temperatures and faster rates than those grown in conventional wet (влажный) oxidation. Presently, efforts to implement low temperature processes have become a significant driving force in the evolution of silicon device fabrication technology. The lower temperature aspect of high pressure oxidation has its greatest potential impact in the high density world of submicron VLSI where improvements in process control precision will have a significant effect on performance and yield.

Thin oxide film grown at low temperature by high pressure oxidation has excellent dielectric breakdown strength.

Developments in high pressure oxidation will become more important with progress in other low temperature processes such as ion implantation, laser annealing, and plasma enhanced technology during the next few years.

Текст 3.9. Прочитайте текст. Разделите его на абзацы и озаглавьте их. Используйте заголовки в качестве плана для пересказа текста.

Optical lithography has indisputably been the leading integrated circuit pattern defining technique for many years. It is essentially two steps. First, the design and fabrication of the optical mask, which is both costly and time consuming, and secondly, the exposure of the wafer, covered with a layer of light sensitive photoresist, to ultraviolet light shone through the mask. The method is ideal for large scale production because once the expensive mask-making process has been carried out, an unlimited number of wafers may be patterned at very low cost to the producer. On the other hand, where specific or semicustom (полузаказные) ICs are concerned this process has proved unacceptable since the cost and time involved in mask fabrication cannot be justified by the production of only a few devices which may require several iterations for optimum results. For these reasons, electron beam direct-write lithography is proving invaluable in the field of application specific or semicustom integrated circuits. This technique allows fast turnaround, a high flexibility and comparatively low cost for very small batches. In addition, the short wavelength of electron-beam offers very high resolution patterning and so may be essential where sub-micron features are required. Despite the possibility of low throughput, e-beam generated patterns allow either simple wafer-scale integration or devices for several customers, each possibly with a variety of trial designs to be implemented on a single wafer. The major advantage of the e-beam's high resolution capability will be nullified if the resist pattern cannot be very precisely reproduced onto the metallization layer. For this reason wet-etching of the metal with its inherent undercutting is particularly unsuitable and plasma-processing becomes necessary. Reactive ion etching is a type of plasma etching where the wafer is placed on an electrode which is capatitively coupled to an RF generator. A second electrode larger than this driven one is grounded and a plasma is generated by electronic excitation of a low pressure gas contained between them. The arrangement of the system is such that the driven electrode experiences a negative bias with respect to the plasma causing positive ions to be accelerated towards the wafer. This means that not only is there chemical reaction causing removal of the metallization but also ion-enhanced chemical etching and physical sputtering to the vertical etching essential for precise replication of the resist pattern. Dry processing has the added benefits of easily handled process materials, easy automation and good reproducibility.

Текст 3.10. Бегло прочитайте текст. Озаглавьте его. Дайте обоснование выбора заголовка. Скажите, что автор говорит об уникальности молекулярной электроники.

Molecular electronics is a new concept of electronic systems. Basically it seeks to integrate into a solid block of the material the functions performed by electronic circuits or even whole systems. Its goal is to rearrange the internal physical properties of the solid in such a way that phenomena occurring within or between domains of molecules will perform a function ordinarily achieved through the use of an assembly of electronic components.

Molecular electronics is the most forward-looking of several modern approaches to the development of small, reliable efficient electronic systems. Almost all attempt to perform the required electronic functions in solid semiconductor-type materials Molecular electronics, however, is unique in its goal of doing away With the traditional concept of circuit components. Should this goal be fully realized, or even partially so, it would extend the capabilities of electronic systems well beyond that which can be achieved today. In addition to lowering size and weight, increasing reliability and reducing power requirements, molecular blocks could make possible the execution of tasks now too complex to be performed economically by conventional methods and permit the performance of electronic functions which cannot be achieved at all with lumped (отдельный) components.

Текст 3.11. Прочитайте текст. Какую новую информацию вы узнали из него?

Dry Process Technology

LSI Technology has been the cutting edge of the innovate semiconductor industry. In the field of the process technology, much effort has been made to improve microfabrication and thinner-film formation technology. In particular, improvements in photolithographic and etching techniques are the keys to the integration of more devices on smaller chips, increases in circuit performance, and improvement in wafer process yield.

Dry etching technology represents a new and exciting method for defining precise images in insulators, semiconductors, and metals. Gas plasma etching technology in dry process like RF sputtering, ion beam milling, reactive ion etching, and reactive ion beam etching is widely used as a fundamental tool for the fabrication of MOS, bipolar LSIs, discrete devices and hard mask. It results in improved image size, simplification of the manufacturing process, precise shape control of fine patterns, and development of a cleaner manufacturing process, compared with conventional wet chemical etching processes.

Recently, MOS LSI has shifted from LSI phase to VLSI phase, which requires a precise pattern less than 3 mm. This transition can be achieved by progress in wafer process technology, including microfabrication as well as device and circuits design technologies. Conventional plasma etching is not adequate in VLSI regions for the delineation of precise patterns because of its inherent undercutting (подтравливающий) effect which results in anisotropic profile of an etched pattern.

Dry etch technologies available for LSI processing are classified into plasma etch, sputter etch and ion beam etch, with items such as etch mode, apparatus and reaction mechanism.

Определите контекстуальное значение выделенных слов.

3.22. Переведите, обращая внимание на контекстуальное значение слов due to, appear, advance:

1. The numerical value of the conductivity changes due to the concentration of impurities. 2. The significance a semiconductor achieved is due to the electrons being raised to the conduction band. 3. Current due to holes injected into the collector from the base can be neglected since it is very small 4. New design tools and development systems are appearing. 5. The limiting point appears to be between 10 and 30 Ohms. 6. Recent technological advances in software development are now opening new horizons. 7. The advances made by device fabrication have allowed all functions to be integrated onto just one chip.

3.23. Выявите контекстуальное значение выделенных слов без словаря:

1. More efficient communication demands a continually increasing level of control in progressively-thinner layers. 2. The extension of any semiconductor technology to small dimensions brings with it a host of new technology, physics and engineering challenges.

Учитесь говорить.

3.24. Подготовьте сообщения по следующим темам:

1. Film technology and semiconductor technology. 2. Silicon for microelectronics. 3. Oxidation and its function. 4. The techniques for the deposition of thin films.

3.25. Докажите правильность или ошибочность следующих высказываний. При доказательстве используйте следующие выражения:

I'm not sure that...; the drawback to the (...) is that it is not useful for...; it requires a complex procedure...; it is expensive... .

1. Plasma technology is presently in wide-spread use in the semiconductor technology. 2. Molecular electronics is the most forward-looking of several modern approaches to the development of small, reliable, efficient electronic systems.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ВТОРОГО ЗАНЯТИЯ)

Учитесь читать и переводить.

Текст 3.12. Прочитайте текст. Изложите свои выводы о преимуществах приборов на арсениде галлия. Используя рисунок, опишите принцип действия прибора. На основе прочитанного и ваших знаний по специальности подготовьте сообщения о: а) технологии полупроводниковых приборов и ИС; б) новых материалах и новой технологии производства ИС, БИС и СБИС.

III — V Semiconductor Integrated Circuits

Ш-V semiconductors attract the attention of scientists and manufacturers working in the field of microelectronics. This interest is based upon the ability of these materials to satisfy a wide variety of needs.

Technological applications include high speed processing, communications, sensing and imagining, and many others. Integrated circuits with various combinations of MESFET, JFET, bipolar, Gunn, Schottky diode, laser diode, optical detector, light guide, acoustic wave, and other assorted functions are being explored, developed and utilized.

One of the first large-scale applications of Ш-V semiconductors was light-emitting diodes (LEDs) which are two terminal devices that emit light when a forward-bias current is passed through a p-n junction. An energy state and device construction is given in Fig. 3.

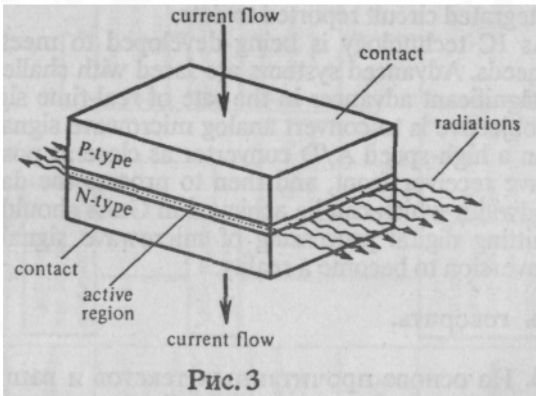


Рис. 3

When an electron in the conduction band combines with a hole in the valence band, the energy is emitted as a photon and light is produced. Of course, non-radiative combination processes and light re-absorption must be minimized for high efficiency. To emit light visible to the human eye, a band gap near 2 eV is necessary to provide the proper photon energy, which precludes use of the semiconductors except GaP, which produces red-green light.

At the beginning of the 1970's, the GaAs MESFET device was developed for use in circuits such as microwave amplifiers operating in the frequencies range from about 2 to 12 GHz. The device is fabricated on a base of single-crystal semi-insulating GaAs. A GaAs film containing a closely-controlled concentration of n-type dopant atoms is epitaxially deposited on the GaAs wafer. The devices are completed by etching "mesas" or islands to electrically isolate the device and by adding low resistance contacts and a gate electrode. The gate length is typically 1 mm.

The first integration of GaAs MESFET transistors into logic gates was done in 1974. These gates have been integrated into gated flip-flop integrated circuits and used for prescalers and time-interval measurements. These GaAs integrated circuits operate at substantially higher speeds than silicon ICs because of a combination of higher transconductance due to higher electron mobility, and lower parasitic capacitance due to higher substrate resistivity. The higher substrate resistivity in GaAs is a result of its larger bandgap. Semi-insulating GaAs material naturally provides device-to-device electrical isolation.

Digital capability in GaAs has passed from the SSI (small-scale integration, ~ 10 gates) realm into the MSI (medium-scale integration, ~ 100 gates), and is headed for LSI (large-scale integration, ~ 1000 gates). Fabrication of an 8 x 8 bit parallel multiplier (1008 gates fabricated from approximately 6000 transistors and diodes) has been recently reported, which is the most complex GaAs integrated circuit reported to date.

GaAs IC technology is being developed to meet important system needs. Advanced systems are faced with challenges which require significant advances in the rate of real-time signal. An attractive objective is to convert analog microwave signals to digital format in a high-speed A/D converter as close as possible to the microwave receiver front, and then to process the data digitally. The bandwidth which can be achieved in GaAs should be capable of permitting digital processing of microwave signals including A/D conversion to become a reality.

Учитесь говорить.

3.26. На основе прочитанных текстов и ваших знаний по специальности подготовьте сообщения на английском языке по следующим темам:

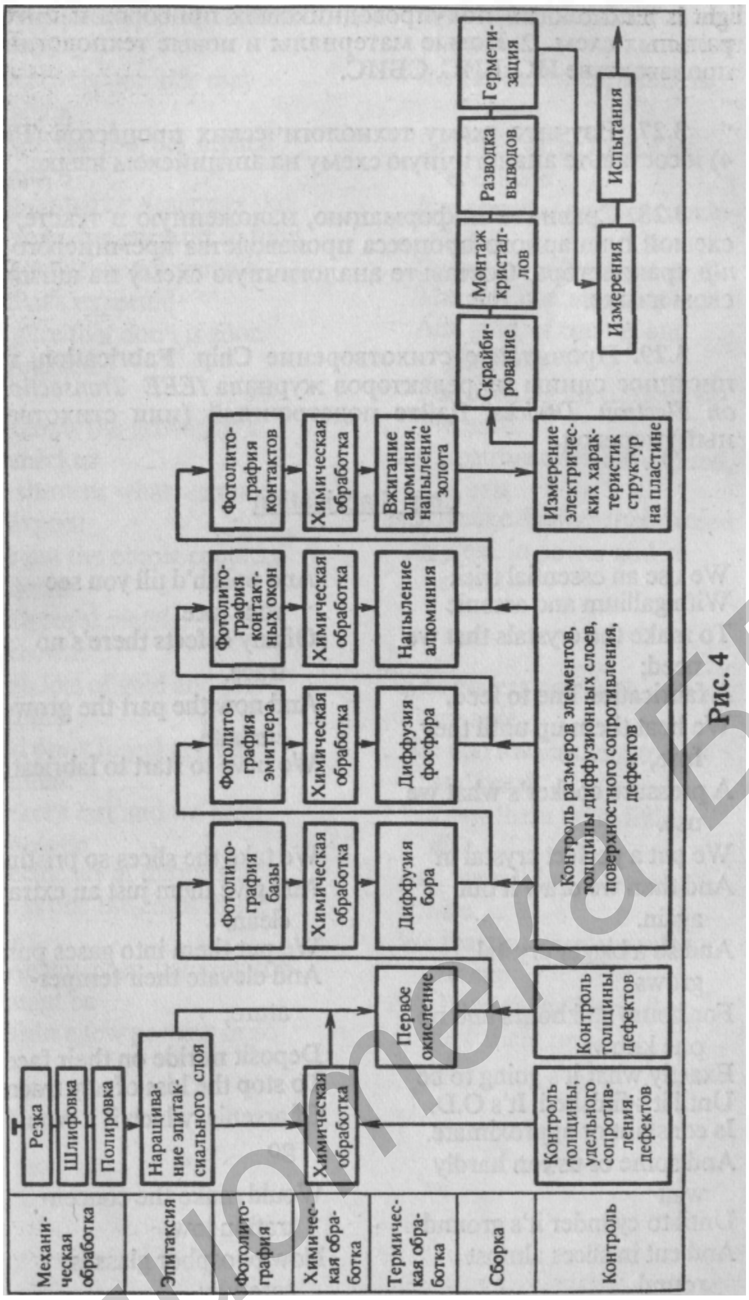


Рис. 4

1. Технология полупроводниковых приборов и интегральных схем. 2. Новые материалы и новые технологии в производстве ИС, БИС, СБИС.

3.27. Изучите схему технологических процессов (Рис. 4) и составьте аналогичную схему на английском языке.

3.28. Сравните информацию, изложенную в тексте, со схемой планарного процесса производства кремниевого p-n-p транзистора. Составьте аналогичную схему на английском языке.

3.29. Прочитайте стихотворение Chip Fabrication, написанное одним из редакторов журнала IEEE Transactions on Electron Devices. Дайте подстрочный (или стихотворный) перевод.

Chip Fabrication

We use an essential trick
With gallium and arsenic
To make the crystals that we need;
A fabrication line to feed.

And polish'd till you see your face.
Of any defects there's no trace.
And now the part the grow-

We heat them up until they fuse,
A pressure cooker's what we use.
We put a perfect crystal in
And then we draw it out again.
And so a bigger crystal grows
For hours and hours and no one knows
Exactly what it's going to be
Until it's finished. It's O.D.
Is constant or approximate.
And some of us can hardly wait
Until to cylinder it's ground
And cut in slices almost round
Added and patterned so that we
Selectively our ions may place,
Not in the fire, but in their space
Appointed by designers skill
To force the currents to fulfil
The power requirements that's expected
(A slice that don't is soon rejected.)

And now the activation's checked
To show us what we may expect
We put the ohmic contacts down
With royal metals, like a crown
With lots of gold and platinum
And don't forget germanium.
Nickel's last and we have heaven

ers hate,
We have to start to fabricate.

We take the slices so pristine
And give them just an extra clean.
We put them into gases pure
And elevate their temperature;
Deposit nitride on their face
To stop the loss of any trace
Of arsenic, which if it would
£0
Would make the concentration low.
Now phosphor glass is carefully
And if they are, then on we go
To the next step, which is the gate
So small we're forced to speculate
Not whether we have made it tall

But rather if it's there at all.
The gate contains titanium
And gold, of course, and platinum.
The opening for the gate recessed,
A treatment, we have found, is best To make devices that exceed
In yield, in power and in speed.

The wafers now with care we take,
We don't want them to fall and break.
We saw them up to little dice

Specifically at minus seven.
We probe the chips to see if we
Have currents that may constant be
Within a few percent or so
And everything is looking nice.
We toast success, we raise our cup
We bond them down, then blow them up.

РАЗДЕЛ ЧЕТВЕРТЫЙ

Основной текст: Computer as It Is.

Грамматические явления: Типы обстоятельств. Способы их выявления в тексте и перевод.

Лексические явления: Контекстуальное значение слов: run, handle, background. Перевод слов с префиксами: extra-, trans-, co-, pre-, post-.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ
(ЗАНЯТИЕ ПЕРВОЕ)

Проверьте, знаете ли вы следующие слова.

1) collect v, scene n, extensive a, intelligence n, extraordinary a, linear a, instruction n, matrices n, command n, accuracy n, total a, detect v, correct a, programming n, variety n

2) mean v, means n, design n, tool n, solve v, purpose n, applicable a, task n, consider v, state v, tremendously adv, simulate v, perform v, signfficant a, attempt n, brain n, surely adv, similarity n, exist v, velocity n, manufacture v, expensive a, influence n, include v, compare v, virtual a, accept v, demand v, require v, level n, merely adv, enable v, improve v, recently adv, lead v, fill v, capability n, previously adv, point v, enhance v, availability n, expect v, particular a, need v

Ознакомьтесь с терминами Основного текста.

1. arithmetic problems — арифметические задачи
2. to digest and analyse measurements — обобщать и анализировать измерения
3. memory-size — объем памяти
4. secondary storage — вспомогательное ЗУ
5. central processing unit —ЦПУ
6. to feed —вводить
7. to take out —выводить
8. to issue commands — задавать команды
9. assembler language — ассемблер
10. running time — время работы
11. bit-map — схема распределения
12. a pointing device — указатель
13. communication modalities - способы предъявления
14. database processing tools - средства обработки базы данных
15. distributed-processing system - система обработки с распределением

ОСНОВНОЙ ТЕКСТ

1. Переведите первую часть (I) Основного текста в аудитории устно под руководством преподавателя.

2. Просмотрите вторую часть (II) Основного текста и кратко изложите ее содержание по-русски.

COMPUTER AS IT IS

I. The word "computer" comes from a Latin word which means to count.[1] A computer is really a very special kind of counting machine.

Initially,[2] the computer was designed as a tool to manipulate numbers and thus solve arithmetic problems. Although designed originally[3] for arithmetic purposes at present it is applicable for a great variety of tasks.

Nowadays computers are considered to be complicated[4] machines for doing arithmetic and logic. The computer may be stated to have become an important and powerful tool for collecting, recording,[5] analysing, and distributing[6] tremendous masses of information.

Viewed[7] in the contemporary[8] scene and historical perspective the computer simulates man. Indeed,[9] two important and highly visible characteristics of man are his intelligence and his ability to perform in and control his environment.[10]

Significantly, man's attempts to understand the phenomena of intelligence, control and power has led to simulations of his brain, of himself and of organizational and group structures in which he most often finds himself. In the last 30 years man has made extensive use of the computer for these simulations.

Surely, there are similarities with human brain, but there exists one very important difference. Despite[11] all its accomplishments,[12] the so-called electronic brain must be programmed by a human brain.

As already stated, originally computers were used only for doing calculations.

Today it would be difficult to find any task that calls for[13] the processing of large amounts[14] of information that is not performed by a computer. In science computers digest and analyse masses of measurements, such as the sequential[15] positions and velocities of a spacecraft and solve extraordinary long and complex mathematical problems, such as the trajectory of the spacecraft. In commerce[16] they record and process inventories, purchases (покупка), bills, payrolls (платежная ведомость), bank deposits and the like and keep track of ongoing business transactions.[17] In industry they monitor[18] and control manufacturing processes. In government they keep statistics and analyse economic information.

A computer system can perform millions of operations a second. In the mid-1950's the average[19] speed of main-memory[20] was about 10 ms, in the mid-1960's 1 ms, in the mid-1970's a tenth to a hundredth of a microsecond and in the mid-1980's it largely increased.

The computer's role is influenced not only by its speed but also by its memory-size. A large memory makes it easier to work with large programs, including data (compare linear programming or regression analysis requiring large matrices).

The increase in main memory capacity has been spectacular[21] too: mid-1950's 100 thousand bits, mid-1960's 1 to 10 million, mid-1970's nearly 1 billion bits. Secondary storage[22] has been greatly expanded by the use of discs. Primary and secondary storage have been integrated by the virtual memory technique.

Although accepted for different purposes computers virtually do not differ in structure.

Any computer is, architecturally, like any other computer. Regardless[23] of their size or purpose most computer systems consist of three basic elements: the input-output ports,[24] the memory hierarchy and the central processing unit. The input-output ports are paths whereby[25] information (instructions and data) is fed[26] into the computer or taken out of it by such means as punch cards,[27] magnetic tapes and terminals. The memory hierarchy stores the instructions (the program) and the data in the system so that they can be retrieved[28] quickly on demand by the central processing unit. The central processing unit controls the operation of the entire[29] system by issuing[30] commands to other parts of the system and by acting on the responses. When required it reads[31] information from the memory, interprets[32] instructions, performs operations on the data according to the instructions, writes the results back into the memory and moves information between memory levels or through the input-output ports. The operations it performs on the data can be either arithmetic or logical.

As stated above any computer is, architecturally, like any other computer in the early days of computers. However, there are differences. They are the following: An early processor used to be made of thousands of vacuum tubes. Reliability was measured in mere hours between failures, and the cooling plant was often larger than the computer itself. Then, the transistor was invented. The number of them was enormous in each mainframe. Besides, in computers of the 1950's, the transistors, diodes, resistors, capacitors and other components were mounted[33] on printed-circuit (PC) cards, A typical 5-in. card contained a dozen transistors and a hundred other parts. A card might have contained a single flip-flop[34] and a thousand cards were required to build each computer.

In the early 1960's semiconductors makers created a wholly new technology: a whole flip-flop could be integrated. Several of integrated circuits (ICs) could be mounted on a single printed card.[35] Soon, improved fabrication processes enabled even more complex circuit to be created in a single IC. The new technology was called medium-scale integration (MSI), and the older technology was labelled[36] small-scale integration (SSI). The progress towards smaller computers continued.

If used for computers discrete transistors were too costly and unreliable, they were too large and too slow.

In the 1960's advances in microelectronic components led to the development of the minicomputer, followed more recently by an even smaller microcomputer. Both have filled a need for small but relatively flexible[37] processing systems able to execute[38] comparatively simple computing functions at lower cost.

In 1971, Intel Corp. delivered the first microprocessor, the 4004. All the logic to implement[39] the CPU, the central processing unit, of a tiny computer was put onto a single silicon chip less than 1/4-in square. That design was soon followed by many others. The progress toward smaller computers is likely to continue: there is already talk of nano-computers and pico-computers.

When the central processing unit (CPU) of a computer is implemented in a single, or very small number of integrated circuits, we call it a microprocessor. When a computer incorporates[40] a microprocessor as its major component, the resulting configuration is called a microcomputer. When the entire computer, including CPU, memory and input-output capability, is incorporated into a single IC, we also call that configuration a microcomputer. To distinguish[41] between the two microprocessor types, we call the latter a one-chip microcomputer.

Modern computers and microelectronic devices have interacted so closely in their evolution that they can be regarded as virtually symbiotic. Microelectronics and data processing are linked.[42]

Today the hardware in data-processing machines is built out of microelectronic devices. Advances in microelectronic devices give rise to advances in data-processing machinery.

As previously pointed computers today are providing an expanding range of services to rapidly growing pool (количество) of users. Such facilities[43] could make our lives easier, and indeed they already enhance the productivity. Yet a bottleneck (трудность) remains which hinders[44] the wider availability of such systems; this bottleneck is the man-machine commumcatic barrier.

Simply put, today's systems are not very good at communicating with their users. They often fail[45] to understand what their users want them to do and then are unable to explain the nature of the misunderstanding to the user. Communication with the machines is sometimes time-consuming.[46] What are the causes of this communication barrier?

One of the most important causes of the man-machine communication barrier is that an interactive computer system typically responds only to commands phrased with total accuracy in a highly restricted[47] artificial[48] language designed specifically for that system. If a user fails to use this language or makes a mistake, however small, an error[49] message[50] is the response he can expect.

П. Several developments have helped to reduce programming effort. High-level languages like FORTRAN, ALGOL, PL-1, and COBOL have replaced assembler languages to a great extent. There is a trend[51] towards languages with a free format and more error checking.[52] Thus programming itself takes less time since fewer errors are made and residual[53] errors are detected and corrected more rapidly. ADA seems destined[54] to become the dominant programming language of 1980's. The term "ADA" comes from the name of Byron's daughter Ada, Lady Lovelace. She was the first programmer in the world.

These high-level languages, however, require more compilation and running time, and more memory space.

Currently,[55] almost all man-machine interaction takes place through typed input and output. Superficially,[56] at least, it is this mode that human communication needs.

However, this type of man-machine communication is rapidly becoming outmoded[57] by a generation of powerful personal computers. These machines are intended[58] for dedicated use by a single individual and feature an integral high-resolution, bit-map, graphics display with a pointing device, as well as a conventional keyboard. This allows the computers to provide multiple independent output channels. Besides extra communication channels, such machines provide for different communication modalities: a graphics screen[59] can display line drawings or images[60] and produce attention-commanding effects such as highlighting (высвечивать) or flashing the background[61] of certain areas or the screen.

The multiple communication channels and modalities allow for more effective interaction.

Recent computer technology advances are the following: Voice annotations, Facsimile images, High-drawn sketches, Animated sequences. The potential advantages of multimedia communications technology are too great to ignore.

Many scientists are conducting a research on man-machine communication. The work is ongoing. Of particular interest are information systems that model complex real-world events.

Active information systems are database processing tools intended to represent and manipulate data descriptions of large real-world systems that have a complex dynamic behaviour.[62]

It is apparent[63] that if the language of recipient and sender differs, the data of the message cannot be used. Problems in understanding the content must be resolved by cooperation between the sender and the recipient.

In automated information systems the computers must receive and at the same time interpret and act on the data. In information systems, to be more explicit, the fields of computers and communications are merging.[64]

In this case data reliability is a significant design factor. More and more data are stored in machines without paper or manual backup.[65] That data must be accurate, protected, and available.

Besides computers and information systems are becoming more distributed. At the same time the integration and coordination of the individual information systems and computers in an organization are becoming more of necessity. This introduces new requirements, design parameters, and tradeoffs.[66]

These considerations affect system issues ranging from the architecture of specific computers to the architecture of overall information systems.

To sum up, computers have certain disadvantages. We have not given them those common-sense skills[67] of interaction and communication that people find so natural and effortless. Nevertheless computers are fast enough to permit man to control mechanisms having rates of response exceeding his own reaction time.

The computer has made it possible to mechanize much of the information interchange and processing that constitute[68] the nervous system of our society.

The versatility[69] and convenience[70] of the microprocessor has altered the entire architecture of modern computer systems. No longer is the processing of information carried out only in the computer's central processing unit. Today there is a trend toward distributing more processing capability throughout a computer system, with various areas having small local processors for handling operations in those areas.

There are a number of advantages to distributed processing. First, since many elements of the computer can be working on different portions of the same task, the work may be done faster. Second, if one element in the network malfunctions, its workload[71] can be shifted to another element or shared among several elements, so that the entire work is relatively immune to failure. Third, the network can be small enough to be contained within a single laboratory or building, or it can be spread out over a wide area.

A major obstacle[72] to designing an effective distributed-processing system is the difficulty involved in writing the system's software, which must enable the various elements of the network to operate and interact efficiently.

The method of processing data as well as available peripheral devices define computer generations.[73] We are now operating third and fourth generation computers and looking ahead to the fifth. An advantage of the fifth generation will be the ability of people without knowledge of programming to use computer terminals. Remote[74] processing will be common too.

Проверьте, как вы запомнили слова.

4.1. Переведите следующие слова, исходя из значений, приведенных в скобках:

1. countless a (бесчисленный), count v; 2. originally adv (первоначально), origin n; 3. distribute v (распределять), distribution n; 4. view n (обзор), view v; 5. accomplishment n (выполнение), accomplish v; 6. recording n (запись), record v; 7. sequent a (последующий), sequence n; 8. storage n (хранение), store v; 9. average a (средний), average v; 10. entirely adv (полностью), entire a; 11. issue n (номер, выпуск), issue v; 12. interpretation n (трактовка), interpret v; 13. flexible a (гибкий), flexibility n; 14. implement v (выполнять), implementation n; 15. distinguish v (отличать), distinguishable a; 16. facilities n (средства выполнения работы), facilitate v; 17. fail v (отказать), failure n; 18. currently adv (в настоящее время), current a; 19. error n (ошибка), erroneous в

4.2. Определите значения английских слов, исходя из контекста:

1. компьютеры — complicated машины; 2. человек всегда attempts познать environment; 3. обрабатывать большие amounts of информации; 4. компьютер previously использовался для counting; 5..компьютеры monitor производственными процессами; 6. в наши дни объем памяти компьютера is spectacular; 7. transactions научного общества будут опубликованы; 8. regardless of размера и назначения компьютер состоит из; 9. информация is fed или выводится через input-output ports; 10. to issue команды в каждую систему; 11. старая технология была labelled SSI; 12. to implement довольно простые функции; 13. to fail выполнить задачу из-за нехватки; 14. операция consumes много времени

4.3. Переведите следующие слова. Обратите внимание на значения префиксов extra- — вне, не-; trans- — за-, через-, транс-, по ту сторону; со- —вместе; fore- —перед, заранее; рге- — до, пред; post- — после.

extra-: extraordinary a, extrasensory a, extraterrestrial c

trans-: transaction n, transatlantic a, transform v

co-: coexist v, coauthor n, cooperate v

fore-: foresee v, foretell v, foregoing a, forerun v, foremost c

pre-: preheat v, predetermine v, prehistoric a

post-: postwar a, postdate v, post-graduate n

Обсудите содержание текста.

4.4. Просмотрите текст еще раз (I часть). Ответьте на вопросы, используя информацию текста:

1. What is the origin of the word computer? 2. What were the first computers intended for? 3. What kind of a machine is the computer? 4. Why has man made extensive use of the computer? 5. What are the similarities of the computer with human brain? 6. What does the computer do in science, in commerce, in industry and in government? 7. Why do we widely use the computer in spite of its high cost? 8. What can you say about the speed and the capacity of computer's memory? 9. What do you know about the architecture of the computer? 10. What's the function of the input-output ports? punch cards? magnetic tapes? terminals? the central processing unit? 11. What can you say about the 1960's advances in microelectronics? 12. What is a microprocessor? 13. What technology is called MSI, LSI, VLSI, VHSIC?

4.5. Обобщите информацию, данную в тексте (I часть).

4.6. Просмотрите вторую часть (П) Основного текста. Сообщите, что вы узнали о:

1. high-level languages; 2. assembler languages; 3. man-machine interaction; 4. personal

computers; 5. different communication modalities; 6. active information systems; 7. data reliability, 8. microprocessor and its abilities

4.7. Сделайте аннотацию второй части (П) Основного текста на английском языке.

Проверьте, умеете ли вы переводить указанные средства выражения обстоятельств.

4.8. Переведите речевые отрезки, в которых обстоятельство выражено:

1. инфинитивом:

а) 1. To manufacture silicon microcircuits well-defined specifications should be observed; 2. To improve the resistance and delay times the designer pays attention to

б) 1. In order to diffuse the semiconductor crystal we add; 2. In order to obtain pure silicon it is necessary

в) 1. so as to make the diode conduct; 2. so as to substitute dopant atoms for semiconductor atoms

2. причастием I:

а) 1. When depositing the material care should be taken; 2. When inserting an atom into the silicon lattice we create

б) 1. While processing the data the computer makes; 2. While comparing the circumstances they noticed that

в) 1. Processing a wafer of silicon we used; 2. Having processed a wafer of silicon we used; 3. Transferring an electron to the impurity atom an adjacent atom fills the hole; 4. Having transferred an electron the adjacent atom creates a new hole

г) 1. Being protected by surface layer of silicon dioxide the adjacent areas can block; 2. Being exposed to diffusion the microscopic regions can be defined

3. причастием П:

а) 1. When cooled the metal provides; 2. When etched the silicon dioxide demands

б) 1. If doped with phosphorus or other pentivalent element silicon is called; 2. If coated with a photosensitive organic compound the surface of the silicon dioxide can change

в) 1. Although accepted for different purposes the computers have the same; 2. Although used for etching an acid can be applied to

г) 1. Viewed from space the Earth seems; 2. Based on reactive gas plasma technology the semiconductor industry can

д) 1. As previously pointed there exist two lines of development; 2. As already stated, oxygen concentration influences many silicon wafer properties.

4. герундием:

а) 1. In obtaining the possibility of change the designer can face; 2. On obtaining the possibility of change the designer could attack

б) 1. With forming high frequency transistors and integrated circuits the engineers could; 2. Without forming high frequency transistors and integrated circuits the engineers could not; 3. By doping the semiconductor we can

в) 1. In spite of being charged the particles can be used to; 2. In addition to creating insulating areas oxidation offers a practical method for growing silicon oxides at low temperatures.

5. словом as и его сочетаниями:

1. as a result of advances; 2. as an example of innovation; 3. as a consequence of the deposition of thin films; 4. as a matter of fact a semiconductor is intermediate between insulators and conductors; 5. as far as the interior of the crystal is concerned; 6. as far as they use poor conductors; 7. as long as oxidation has been a keystone process of silicon device technology they; 8. as soon as plasma etching was used they, 9. as much as possible; 10. as thin as possible; 11. such as; 12. as follows; 13. as distinguished from the tube

Учитесь читать.

Текст 4.1. Прочитайте текст. Скажите, что вы узнали о: speed of the computer, hardware, video display, key board, the major piece of hardware. Прочитайте текст еще раз. Озаглавьте его.

A computer is nothing more than a collection of circuits that do a few simple tasks, one at a time. The key is the speed at which these circuits operate and signals that control the flow of electricity through the circuits.

So, how about a tour in the computer jungle? We start with a look at the hardware itself. The part that looks like a small television set is called a video display or CRT for cathode ray tube or simply the tube. It actually is a lot like a television set in that it may display several colors or just one.

Next is the keyboard which allows the user to communicate with the computer. It is important that the keys be comfortable.

The last major piece of hardware is the processor and disc storage unit or units. This may be one box or several different boxes.

Текст 4.2. Прочитайте текст. Назовите предмет описания. С чем его сравнивают? Какие операции он может выполнять?

The Heart of the Computer

The processor is the "brains" of the computer, the location of those fantastically small circuits. Think of it as an overworked adding machine that also can make simple logic decisions.

It can decide that two numbers are equal or not equal, that a certain condition does or does not exist in the circuitry. It can decide that things are true or false based on rules the programmer supplies to make that decision. This, combined with the ability to add and subtract at lightning-fast speeds and store the results of these processes, allows the programmer to give step-by-step instructions to be carried out on command.

Текст 4.3. Переведите текст устно без словаря. Время перевода не должно превышать 5 минут. Значения выделенных слов вы сможете понять из контекста. Озаглавьте текст.

Although the idea of an automatic computing engine occurred first to Charles Babbage in 1832, it was more than a century later, in 1945, that John von Neumann set out the principles that were to fix the pattern of computer design for the next twenty years. We are now operating third and fourth generation computers, and looking ahead to the fifth, but these are generations marked by evolutionary changes in component technology rather than by revolutionary new concepts. Most of today's computers follow the von Neumann model, and probably many of tomorrow's will do so also. In particular, they have a rather rigidly organized store, holding both instructions and data; and, although some overlap of operations occurs, in general they tiptoe through their programs in ministeps. There can be no doubt that computers of this kind are powerful, versatile tools; but it would be surprising indeed if one type of machine were to prove equally suitable for all types of problems; and it may be that some problems of practical interest to us are too difficult, or too expensive, to solve on von Neumann machines.

Текст 4.4. Переведите текст письменно со словарем. Время перевода не должно превышать 15 минут.

Personal Computer

The first personal computer (PC) was put on the market in 1975.

Today the personal computer can serve as a work station for the individual. Moreover, just as it has become financially feasible to provide a computer for the individual worker, so also technical developments have made the interface between man and machine increasingly "friendly", so that a wide array of computer functions are now accessible to people with no technical background.

A personal computer is a small computer based on a microprocessor; it is a microcomputer. Not all microcomputers, however, are personal computers. A microcomputer can be dedicated to a single task such as controlling a machine tool or metering the injection of fuel into an automobile engine; it can be a word processor, a video game or a "pocket computer" that is not quite a computer. A personal computer is something different: a standalone computer that puts a wide array of capabilities at the disposal of an individual.

The first generation of true personal computers, which came on the market between 1977 and 1981, had eight-bit microprocessors; the most recently introduced systems have 16-bit ones. Now 32-bit microprocessor chips are available, and soon they will be included in complete computer systems. As for clock frequency, the trend has been from one megahertz (one million cycles per second) a few years ago to 10 megahertz or more today.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ПЕРВОГО ЗАНЯТИЯ)

Изучите следующие гнезда слов и словосочетаний.

1.count v 1. считать, подсчитывать; 2. полагаться на count n 1. подсчет; 2. единица подсчета
countable a исчисляемый
counter n счетчик
2.initially adv в начальной стадии, в исходном положении
initial a начальный, первоначальный
initiate v 1. положить начало; 2. возникнуть
3. originally adv сначала, первоначально
original a 1. первоначальный, исходный; 2. подлинный
originate v 1. давать начало, порождать; 2. брать начало
4. complicated a сложный; запутанный
complicate v усложнять
5. record v 1. записывать; 2. регистрировать
recording n запись
file recording запись файла
master recording главная запись
recorder n записывающее устройство
6. distribute v 1. распределять; 2. распространять
distribution n распределение
defect-density distribution распределение плотности дефектов
distributor n распределительное устройство
7. view n 1. точка зрения; 2. вид; взгляд
view v 1. рассматривать; 2. учитывать
view point точка зрения
object in view поставленная цель
8. contemporary c 1. современный; 2. одновременный
contemporary n современник
9. indeed adv на самом деле, действительно
10. environment n окружение, среда
environmental testing испытание в условиях, моделирующих эксплуатационные
11. despite prp несмотря на
in spite of несмотря на
12. accomplishment n 1. выполнение; 2. завершение, достижение
accomplish v 1. выполнять; 2. завершать, достигать; 3. совершенствовать
13. call for v 1. требовать; 2. предусматривать
call attention to обращать внимание
14. amount n 1. величина; количество; 2. сумма, итог
amount v 1. составлять; 2. доходить до; сводиться к
15. sequential a 1. являющийся продолжением; 2. последовательный
sequence n 1. последовательность; 2. следствие, результат; 3. следование, ряд
sequence of events ход событий
in sequence один за другим
sequencer n 1. установка для программируемой вклейки компонента в ленту; 2. устройство задания последовательности
sequencing n задание последовательности

16. commerce и торговля
commercial a 1. торговый; 2. серийный
17. transactions n pl 1. труды (научного общества); 2. ведение деловых операций
18. monitor v следить, контролировать
19. average в 1. средний; 2. промежуточный
average v 1. составлять в среднем; 2. усреднять
average и средняя величина
20. main-memory n главная память
main a главный, основной
mainly adv главным образом; большей частью
mainframe n основной компьютер
21. spectacular a эффектный, захватывающий
22. storage n 1. хранение; 2. запоминающее устройство (ЗУ), память
store v хранить, накапливать; запоминать
23. regardless of prp не считаясь; независимо от; несмотря на
regard v 1. смотреть на что-л.; считать; 2. рассматривать;
3. касаться; 4. относиться
in regard to относительно; что касается
as regards относительно
24. port n: input port вход
output port выход
25. whereby adv посредством чего-л.; тем самым
26. feed v 1. питать; 2. подавать, снабжать
feed n 1. питание; 2. снабжение
feedback n обратная связь
feeder n подающий механизм
27. punch card перфорированная карта
punch v компостировать, пробивать
card n 1. карта; 2. плата, печатная плата
double-sided card двусторонняя печатная плата
28. retrieve v 1. восстанавливать; 2. исправлять; 3. отыскивать информацию
retrieval n 1. восстановление; 2. поиск
29. entire a 1. целый, полный; 2. весь
entirely adv полностью; совсем, совершенно
30. issue у 1. происходить, получаться из; 2. вытекать; 3. выпускаться, издаваться
issue n 1. вопрос; 2. выпуск; 3. результат, исход
31. read v 1. читать, считывать; 2. снимать показатели
readings n показатели прибора
to read while writing считывать одновременно с записью
card read считывание с перфокарт
readback n считывание только что записанной информации
32. interpret v 1. преобразовывать; 2. объяснять, толковать
33. mount v 1. монтировать; 2. собирать
mounting n 1. установка; 2. монтаж, сборка; 3. опора
chip mounting монтаж кристаллов (на платах)
34. flip-flop n 1. триггер; 2. бистабильный мультипликатор
clocked flip-flop тактируемый триггер
gated flip-flop стробированный триггер
35. printed card перфокарта; печатная схема
printed circuit печатная схема
print n трафаретная печать; сеткография
contact print контактная фотолитография

screen print трафаретная печать
printer n принтер
printing n литография
36. label у обозначать, маркировать
labelling n маркирование
37. flexible a гибкий, подвижный
flexibility n гибкость
38. execute у выполнять, исполнять
execution n выполнение
39. implement v осуществлять, выполнять
implementation и осуществление, выполнение
40. incorporate v 1. включать; 2. объединять
incorporation n объединение, корпорация
41. distinguish v 1. различать; 2. отличать, выделять
distinguished a выдающийся, известный
as distinguished from в отличие от
42. linkv соединять
link n связь; звено
43. facilities n pl 1. устройства; 2. возможность; условия
facilitate v облегчать
custom facilities аппаратура для разработки заказныхИС
clean/white-room facilities обовудование для чистой комнаты
design facilities аппаратура для проектирования
fabrication facilities технологическое оборудование
44. hinder v 1. мешать, препятствовать; 2. задерживать
hindrance n помеха, препятствие
45. fail v 1. отказать действовать; 2. не удаваться; 3. быть не в состоянии
without fail непременно, обязательно
fail-proof с безотказный
fail-safe a надежный при отказе отдельных элементов
failsoft a ограниченно надежный
failure n 1. повреждение, отказ, неисправность; 2. неспособность, невозможность degradation failure постепенный отказ
infant failure ранний отказ
oxide failure дефект оксидного слоя
46. consume v потреблять, поглощать
consumption n потребление, расход
47. restrict v ограничивать
restriction n ограничение
48. artificial a искусственный
49. error n ошибка; погрешность
trial and error method метод проб и ошибок
erroneous a ошибочный
50. message n 1. сообщение; 2. информация
51. trend n 1. общее направление, тенденция; 2. ход, течение
trend v 1. иметь тенденцию; 2. отклоняться
52. cheek v 1. проверять, сверять; 2. задерживать; 3. соответствовать; 4. совпадать
check n проверка, контроль
checker n прибор для проверки
crystal checker прибор для проверки кристаллов
check-out n проверка, отладка
53. residual a остаточный

residual n 1. остаток; 2. разность
residue n 1. остаток; 2. осадок
54. destined a предназначенный
destine v 1. предназначать; 2. назначать
55. currently adv в настоящее время
current a современный, текущий; имеющийся
current n поток, ток
56. superficially adv поверхностно, на первый взгляд
superficial a поверхностный, неглубокий
57. outmoded a устаревший
58. intend у 1. намереваться; иметь в виду;-2. предназначать
intended a предполагаемый; предназначенный
59. screen n 1. трафарет; 2. экран; 3. сетка; 4. отбраковка
screen у 1. защищать; маскировать; 2. проверять
screener n установка трафаретной печати
60. image n 1. изображение; 2. отражение; 3. подобие
image v формировать рисунок
to image a pattern onto a wafer переносить рисунок на полупроводниковую пластину
imagery n изображение, рисунок
61. background n 1. фон; 2. основа; 3. подготовка; 4. предпосылка, история вопроса
historical background история вопроса
background of experience накопленный опыт
62. behaviour n 1. поведение; 2. режим; 3. характеристика
behave v вести себя
transient behaviour переходный режим
63. apparent a 1. очевидный, явный; 2. наблюдаемый
apparently adv очевидно
64. merge v 1. сливаться, соединяться; 2. поглощать
65. backup n 1. поддержка; 2. резервирование
66. tradeoff n 1. согласование; 2. компромисс; 3. сравнительная оценка; альтернатива
trade off v 1. согласовывать; 2. сопоставлять
trade-off studies сравнительные исследования
67. skill n умение, опыт
skilled a квалифицированный, опытный
skilful a искусный, опытный
68. constitute v 1. составлять; 2. основывать
69. versatility n разносторонность, многогранность
versatile a многосторонний, гибкий; универсальный
70. convenience n удобство
convenient a удобный, подходящий
71. workload n: load n 1. нагрузка; 2. груз
load v загружать
loaded a 1. нагруженный; 2. смонтированный
72. obstacle n препятствие, помеха
73 generation n 1. поколение; 2. порождение; 3. создание, образование
generate v 1. порождать; 2. производить, генерировать
generator n 1. генератор; 2. датчик, измерительный преобразователь
74. remote a 1. отдаленный; 2. действующий на расстоянии, дистанционный

Проверьте, как вы запомнили слова.

(1 —10) to count the layers, to count dice, countable benefits; an initial mode; originally the computer is gigantic; complicated arrangements; to record large amount of information; to

distribute functions, the distribution of wafers; to view achievements; to view the resources; the point of view of an engineer; to protect environment; the environments of the spacecraft

(11 - 20) despite the circumstances; to accomplish the task; to call for amplification; an amount of acid; the sequential positions of slices, the sequence of operations; the sequence of events; to use computers in commerce; to expose transactions; to monitor production processes; an average amount of alloy, to increase memory-size

(21 — 30) the memory capacity is spectacular; to store information; regardless of the advances; to feed information through the input-output ports; the instructions are retrieved on command; to fill an entire space; to depend entirely on gap; to issue commands

(31 — 40) to read information from the memory; to affect the instrument readings; to interpret the commands; to mount substrates; to mount IC on a single printed card; to need a flexible processing system; the flexible processing system; the flexibility of the procedure; to execute computing operations; to execute a task; to implement sputtering, to implement a substitution; to incorporate many components

(41 — 50) to distinguish objects at a distance; to distinguish tools; to link the tops; the link between two species; the sequence of facilities; to establish new facilities; to hinder the passage; to hinder the availability, to fail to insert; the failure of a processor; the device failed; to improve the tool without fail; to consume much energy, to restrict the consumption; a highly restricted artificial language; the origin of an error; an erroneous response; to receive an error message

(51 — 60) the trend of development; to check the performance of an operation; to denote residual errors; a current event, current efforts to define; superficial knowledge; the mode of handling in formation; to intend to complete, an intended perfection; the image of a mask

(61 — 70) the background of the screen; the background of an engineer; the background of the technique; the behaviour of electrons; an apparent shift; an apparent mark; roads merge; to trade off the responses; prediction tradeoff; the versatility of microprocessors; a convenient pattern; the convenience of processing

(71 — 74) an obstacle to designing; the fifth generation of the computers

Задания к Основному тексту.

4.9. Запишите кратко содержание первой части (I) Основного текста с помощью предикативных групп, например:

1. ... comes from a Latin word; 2. ... was designed as a tool; 3.... are considered to be a complicated machine, etc.

4.10. Найдите в тексте английские эквиваленты следующих речевых отрезков:

1. средство для сбора, записи, анализа и распределения огромной массы информации; 2. попытки понять процессы мышления; 3. интенсивное применение компьютера для моделирования; 4. решение сложных математических задач; 5. хотя компьютеры применяются для различных целей; 6. независимо от размера и назначения системы компьютера состоят; 7. управлять операциями всей системы, подавая команды; 8. развитие микроэлектронных компонентов привело к появлению микрокомпьютера; 9. удовлетворить необходимость в малых, но относительно гибких процессорных системах; 10. определить различие между двумя микропроцессорными схемами; 11. препятствовать широкому распространению таких систем; 12. часто не могут понять пользователя

4.11. Устно переведите вторую часть (П) Основного текста.

4.12. Письменно в виде аннотации изложите по-русски содержание второй части (П) Основного текста.

4.13. Задайте вопросы собеседнику по содержанию Основного текста. Типы вопросов:

1. What is the (computer) like? 2. What is the (computer) used for? 3. What does the (computer) do in (commerce)? 4. What do you know about the (central processing unit)?

4.14. Дайте определения следующих терминов:

1. input-output ports; 2. memory capacity, 3. average speed of main memory; 4. primary

and secondary storage; 5. punch cards; 6. small-scale integration; 7. interpretation of instructions

Проверьте, сможете ли вы перевести.

4.15. Переведите, обращая внимание на форму выражения обстоятельств:

1. The design effort necessary for assembling several dice within the same package was more easily and earlier achieved than the integration of several discrete components onto a single die. 2. Being quite different from vacuum tubes and transistors, masers operate entirely on quantum principles. 4. Using the same mask-making programs and machines as for silicon, we use photolithography to define the topology of resistors, capacitors and interconnections. 5. In order to shorten the time required to perform instructions, it is desirable to perform as many operations as possible in parallel. 6. To be more economically competitive, more and more systems will incorporate micros. 7. By fabricating dozens of transistors together on a single small silicon chip, using the same fabrication techniques used for single isolated transistors, a whole flip-flop could be integrated. 8. Viewed from the outer space the most striking feature of the Earth is the large expanse of water.

Учитесь читать и переводить.

Текст 4.5. Прочитайте текст и составьте аннотацию на английском языке.

Computer Trends

Now that we are well into the Eighties, we can ask what new computer developments we should expect for the remainder of this century and on into the next. Are there new breakthroughs or turning points forecastable or will the decade see only continued, rapid evolutionary developments?

Microchip hardware components, computers memory and software have been moving into the future along multiple trend paths. Some of these trends are taking new directions, while others are merging.

Computer technology will soon advance into mixed-technology, silicon microchips that combine digital and analogue circuitry. Contained within the same component chips could be: digital logic, memory, communications circuits, signal processing, sensor circuits, interface logic, data converters, display elements, voice synthesis, voice recognition and much more. In this fashion, a new set of basic components will exist to smarten up (улучшить действие) most computers and communication subsystems in the future — thus marrying the computer with communications and forcing more changes, more uses and more distribution.

Multichips will continue to become more dense, moving from Very Large-Scale Integration (VLSI) circuit components to Very High-Speed Integrated Circuits (VHSIC) to Ultra Large-Scale Integration (ULSI) to wafer-multichip systems components. As circuit integration level increases, computers of larger and larger capability will be integrated as single microchip components — thus providing "component-computers".

Next, multiple computers will be placed into single microchip components and later on wafers as "component computer systems". Step function increases in microchip circuit density also lead to step-function increases in computer capability. This trend allows future microcomputers and chip component computers to reach mini- and maxicomputer capabilities, thus causing their possible future takeover of (одержать победу над) or merger with larger computers, especially, as computers move beyond super micros using VHSIC and ULSI hardware.

The higjaer the integration level, the more opportunities — and the longer it takes to use up opportunities once a manufacturer or a nation chooses a technology level, e.g. VLSI, or VHSIC at 30.000 circuits or at 300.000 circuits as a standard.

Текст 4.6. Переведите текст письменно со словарем. Время перевода —10 минут.

Languages

The proliferation of languages that has been going on for some time will continue indefinitely. Most of the new languages will be aimed at making it easier to perform specialized kinds of processing. The trend will be away from Procedure Oriented Languages toward languages that will allow the user to specify what task the system is to perform, rather than how the system will perform the task.

By far the greatest challenge in the language area will be to develop new and more powerful general-purpose languages. The concepts of parallel processing and distributing computing call for new approaches to the description and solution of large-scale, complex problems. These languages will have to accommodate a degree of system complexity and coordination far beyond the ability of most existing languages.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ (ЗАНЯТИЕ ВТОРОЕ)

Проверьте домашнее задание.

4.16. Ответьте развернуто на следующие вопросы:

1. In what way can electronic brain be compared with human brain? 2. What is a micro? How is it used? Is it merely a cheap replacement for a conventional computer? 3. What problems does the advent of the micro pose? 4. What do we mean by the "machine communication barrier"? 5. What steps can be taken to overcome the barrier? 6. What are the disadvantages of the high-level languages? 7. What are the main features' of information systems? 8. What changes does the world of personal computers bring about?

4.17. Дайте определения следующих терминов:

computer, microcomputer, processor, microprocessor, input-output operations, main memory, assembler language, high-level language, data, database system

4.18. Расшифруйте следующие сокращения: CPU, ALU, SSI, MSI, VLSI, VHSIC

4.19. Обсудите предлагаемые темы. При обсуждении используйте следующие выражения:

1.... an important element of our daily life; 2.... has opened wider opportunities; 3.... micros are merely computers on a chip or two

Темы:

1. The uses of computers. 2. The potential for microcomputer application. 3. Hardware and software. 4. The heart of the computer.

Учитесь читать и переводить.

Текст 4.7. Прочитайте текст и определите основные направления в развитии архитектуры суперкомпьютеров. Объясните необходимость изменений в архитектуре.

New Design Strategies

To keep pace with the multiplicity and complexity of large scale applications, tomorrow's macros will need increasingly higher throughputs and greater memory capacity—while, at the same time, being easier to operate. The needed improvement is too great to be accomplished by piece-meal (отдельный) progress in components. Radical changes in basic architecture will be required.

New design strategies are already showing up in some extra-high performance machines, but the full impact of these changes will not be felt for several years.

The two key points are to be emphasized when dealing with the problem of new designs — parallel processing and distributed computing.

Although continued progress is foreseen in the execution speed of circuit components, the dramatic progress needed to increase throughput cannot be achieved solely through improvements in circuitry. One approach that will help is parallelism.

Basically, parallel processing involves the use of parallel or redundant circuits to accomplish similar or different functions. In the first case, the computer achieves a higher throughput merely by having more circuits working at one time. In the case of different functions, throughput is increased by having different portions of the computer work on different aspects of a problem at the same time, instead of having the computer step through series of functions sequentially.

Whereas parallel processing is fundamentally an approach to solving problems, distributing computing refers to the form in which parallelism will most likely be executed. Although it is possible to design parallelism into the massive CPU of a mainframe macro, tomorrow's big computer will achieve this capability through combinations of separate processors — distributed computing.

The distribution concept will be patterned after today's computer networks. In the macros of the future, several small processors—each dedicated to specific specialized functions —will be interconnected in parallel or tied together by a large central processor. The various elements will be closely coordinated to solve large-scale problems and/or control complex processes.

With this computer configuration, the small processors operate semi-autonomously and are fairly intelligent in their own right (сами по себе). Thus, a computer can be made up of a collection of 16-bit units that are capable, together, of producing a 64-bit result every IC ns. Each unit might control itself via microcoded instruction sets which allow it to tackle specific functions at its own speed. The various units communicate with each other and the main CPU only in so far as is necessary.

Distributed computing will eventually make the traditional, single mainframe computer obsolete.

Текст 4.8. Прочитайте бегло текст и укажите основные преимущества компьютеров при решении сложных задач, рассматриваемых в тексте.

Big Problems Require Big Computers

The expanding role of the macro computer is due to the ever-increasing number of applications that transcend (выходить за пределы) the capabilities of micros and minis. Certain real time problems — such as the preparation, launch, and guidance of a space vehicle or satellite, for example, require millions of calculations for each external stimulus, with response time of only one or two seconds at the most. The large on-line databases required to solve such problems and the interdependent nature of the calculations can be handled only by the huge memory capacities and high throughputs of large-scale computers.

Other problems are so complicated that millions of bytes of high-speed storage are necessary to fully describe them and solve them in tune for the answers to be useful. A weather-prediction model and other complex simulations are cases in point.

For example, if weather prediction is to be possible, countless factors such as wind currents, solar effects, and even planetary configurations must be calculated, correlated, and simulated.

Similar problems are involved in the mapping of ocean processes, and probing out of new energy sources.

Large-scale computers are necessary to do the complex processing, necessary to create intricate electronic and photographic image from the coded data sent by space craft and satellites.

In the realm of pure science macro computers may one day be used to model and bring some order to the incredibly complex realm (область) of subatomic particles.

Some complex problems can be split into pieces and handled by several independent small computers or by a network of interconnected small computers. But when a multiplicity of operations must be accomplished simultaneously and/or where a high degree of data integration is necessary, the only answer is a macro computer.

Текст 4.9. а) Переведите текст устно без словаря. Значения выделенных слов вы сможете понять из контекста.

б) Прокомментируйте высказывание автора:

"... the emergence of database technology is probably a revolutionary development in the world of information processing by computers."

Database Systems

Database systems were bora and have evolved as an application technology due to the necessity for managing the large amount of data produced in the real world. However, it was soon recognized that the emergence of the technology is one of the most significant features of transition in computer application from data processing to information processing and further to knowledge processing. The problem so far has been involving various topics: data models, database languages and query (запрос) processing, database design, database system design, file organization, database system evaluation, integrity, database machine, distributed database system, high level database applications and so on.

Database systems were the means by which computer technology began to make effective and systematic use of a permanent store, which has been an important feature of information processing capability belonging only to human beings. In this sense, the emergence of database technology is probably a revolutionary development in the world of information processing by computers. It made computers more like human beings than ever and offered us a chance to reconsider the information processing by computers in comparison with that of the human beings. It is expected that analyzing the problem solving process and creative activity by man will serve us in designing future information processing systems.

Knowledge representation has also become a crucial issue in the field of artificial intelligence. In fact, whichever system we consider, how to represent knowledge and then utilize it on a computer is a key problem for the realization of advanced information system such as natural language processing, image or speech understanding, machine vision, intelligent information retrieval, and intelligent man-machine communication.

Текст 4.10. Прочитайте текст и составьте на английском языке его структурно-логическую схему.

Breaking the Man-Machine Communication Barrier

Technological advances in computers can be used to enrich communications between people. When a person edits a document or writes an electronic message, the computer is not the intended recipient of the result, but merely stores or transmits that information. In the paperless office of the future, most of the letters, memos, and reports that are currently printed on paper will instead be stored in the office computer system. But before it can fill this role successfully, the computer system must provide con venient ways to include figures and photographs in documents and allow comments to be "pencilled into the margin (поле)" of an electronic page. In other words, it must provide mechanisms for human communication that are at least as convenient and efficient as current paper-based communication systems.

Just as graphic displays suggested less obtrusive (назойливый) ways of notifying the user about error corrections, several supplements to written communication have also been made possible by recent computer technology advances. One of them is voice annotations.

The recording and playback of digitized speech is now feasible even for inexpensive computer systems, primarily as a result of the recent development of special-purpose integrated circuits intended for digital telephone systems. The obvious advantage of the recorded speech is that it is faster and easier for the human user than the corresponding typed input; it is therefore well suited to the role of "pencilled notations" on existing documents. For example, the recipient of a document should be able to point to a portion of the text, record a spoken comment at that point, and return the document to its originator, who can replay the recorded message at his convenience.

Текст 4.11. Бегло прочитайте текст. Озаглавьте его. Дайте обоснование выбора заголовка. Значения выделенных слов вы сможете понять из контекста.

The transistor was the basis for the second generation of computers — a generation that lasted about 15 years. The third generation began in the mid-1960s and produced two types of offspring: the mainframe computer and the minicomputer. The mainframe computer looked like a computer. It was (and still is) big, required air conditioning or even direct liquid cooling to keep its hot electrical components working (as a direct consequence of its still-substantial power consumption), and had (and still has) to be attended by a group of specialists: systems programmers, applications programmers, and operators. All the advantages of integrated circuits were used in these systems to make them extremely powerful.

The new entrants upon the scene were the minicomputers. Much smaller and less expensive than mainframes, the minis first found application in the field of industrial process control and small-job data processing, but their capabilities continued to expand. They began to appear in places other than the Computer Center.

The fourth and present generation of computer was ushered in by the first commercial production of a microprocessor, the Intel 4004, in 1971. This was the first occasion in which the entire cen tral processing unit (CPU), the "brains" of a computer, was put on a single chip. With a CPU chip and a few memory chips and other integrated circuits, a fully functional, general-purpose, stored-pro-gram computer can be built that weighs a few ounces and consumes a few watts of power.

During twenty years the computer has come a long way. At the upper and of the scale are super-computers, such as the Soviet computer Elbrus-3 being developed by the group of young scientists, performing more than 20 million instructions per second. And there are more to come.

Текст 4.12. Переведите письменно со словарем. Время перевода —10 минут.

<u>High-Level Languages</u>

High-level languages are to assembly- or machine-language programming what integrated circuits are to discrete logic — they collect small, related elements into neat modules. The benefits, too, are similar. Just as the hardware designer needs fewer components to build a system, the programmer thinking in a high-level language needs fewer lines of code to make a system go.

Such languages are not the perfect solution for all programming problems. They require a lot of memory, for example, and in the case of microcomputers, that was economically impractical till quite recently. But now they can often be used to cut expensive rnicrocomputerfirmware development time, especially if their user is aware of the languages' strengths and weaknesses.

Определите контекстуальное значение выделенных слов.

4.20. Переведите, обращая внимание на контекстуальное значение слов run, tradeoff, background:

1. The system ran in continuous operation for several months. 2. The problem is now ready for running. 3. The value of variable/ is computed at run time. 4. A factory can run non-stop. 5. Many new projects are being run. 6. This paper will explain the background and principles needed to select and apply microprocessors and microcomputers. 7. Some readers have no background in digital electronics. 8. Tradeoffs versus other logic solutions must be considered more carefully than ever before.

4.21. Определите контекстуальное значение выделенных слов:

1. The concept of distributed computing is spurred by the inexpensive availability of minis and micros. 2. The mind boggles at the concepts microcomputers permit designers to realize. 3. The potential for microcomputer applications has already outstepped even the most inventive minds. 4. One-chip computers rival the power of the digital computers.

Учитесь говорить.

4.22. Обсудите следующие темы:

1. The contemporary scene and historical perspective of the computer. 2. The processor is the "brains" of the computer.

4.23. Докажите правильность или ошибочность следующих высказываний:

1. The impact of micros on the big machines, especially large centralized computer systems, is that large systems will decline in number but increase in power. 2. Designers of mini-micro systems are becoming aware of their background limitations. The digital designers are finding that software is an indispensable tool, and the programmers are learning that lack of knowledge in electronics may be disastrous to successful project realization.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ВТОРОГО ЗАНЯТИЯ)

Учитесь читать и переводить.

Текст 4.13. Прочитайте текст. Подготовьте сообщение на тему "Some facts from the history of computers".

<u>The Development of Computers</u>

Modern computers come in an enormous variety of sizes and shapes, ranging from the smallest personal computers to huge machines filling warehouse-sized rooms. Nearly one hundred fifty years ago there were no such things as computers — at least in the sense we are using the term now. There have been calculating aids for millennia. Knotted ropes, marks in clay, the abacus, and the soroban are all methods of keeping track of numbers. But the stored-program computer really did not come into existence until the 1830.

A score of years after the war of 1812, an English inventor and mathematician Charles Babbage was commissioned by the British government to develop a system for calculating the rise and fall of the tides.

Dozens, even hun reds of clerks busily calculating away throughout their lifetimes could not get their job done, let alone do it without errors. Babbage decided to build a device he called an analytical engine.

He designed the first programmable computer, complete with punched cards for data input. Incidentally, the punched card was not invented for use with the computer but was used as early as the 1700s by Bouchon and in the 1800s by Jacquard to control automatic looms (станок). Babbage adapted the idea for his computer, and it has been with us ever since.

Babbage gave the engine the ability to perform different types of mathematical operations. The machine was not confined to simple addition, subtraction, multiplication, or division; it had its own "memory" and, because of this "stored program", the machine could use different combinations and sequences of these to suit the purposes of the operator. It became an autonomous machine, able to perform on its own, once commanded to do so as were the automated looms and the common clock.

The machine of his dreams was never realized in his lifetime.

Yet Babbage's idea didn't die with him. Others made attempts to build mechanical, general-purpose, stored-program computers throughput the next century. In the process it became clear that mechanical methods of general-purpose computing on all but the most modest scale were simply not practical.

In 1941 a relay computer was built in Germany by Conrad Zuse. It was a major step toward the realization of Babbage's dream. The logical operations of the computer were alterable by changing the interconnections among the relays. At the same time, in the United States, International Business Machines (IBM) built a machine in cooperation with scientists working at Harward University under the direction of Prof. Aiken during the years from 1939 to 1944. The computer, called the Mark I Sequence-Controlled Calculator, was built to perform calculations for the Manhattan Project, which led toward the development of the atomic bomb.

The relay computer had its problems. Since relays are electromechanical devices, the switching contacts operate by means of electromagnets and springs. They are still fairly slow and very noisy. They also consume a lot of power, if their contacts become dirty or corroded, they are unreliable.

The gadget (приспособление) that was the basis for the first computer revolution was the vacuum tube, an electronic device invented early in the twentieth century. The vacuum tube was ideal for use in computers. It had no moving parts, or at least no mechanical moving parts. It switched flows of electrons off and on at rates far faster than possible with any mechanical device. It was relatively reliable, lasting hundreds of hours before failure. Previously, computer designers could think only in terms of hundreds of calculations in a program to be run on a mechanical computer. Now they could easily conceive of programs with thousands of related computations using a vacuum-tube computer. The first vacuum-tube computer was built at Iowa State University at about the same time as the Mark I. It was the beginning of the revolution. It was called ABC (Atanasoff-Berry Computer). From the ABC a number of vacuum-rube digital computers evolved.

A splendid example of these first generation electronic computers is ENIAC (an acronym for Electronic Numerical Integrator and Calculator). ENIAC was over 90 tons and bulging into 3000 cubic feet and costing millions. Its 18 thousand vacuum tubes demanded 140 kilowatts of electrical power, enough to supply a block of buildings of respectable size. With its 16,000 bytes of random access memory and its 100-kilohertz clock, it was not quite up to the basic computer capability of modern computers. Since its programs were hardwired — that is, the programs operating the computer were established by physically changing the patterns of the wires interconnecting the vacuum tubes — it was not so flexible in its operation.

From the university laboratories the computer finally entered the wider world in 1951 with the delivery of the first UNTVAC I (Universal Automatic Computer).

In 1948 the next key element in spreading the practical—and impractical —applications of computers, the transistor, came into existence. The potential advantage of the transistor over the vacuum tube was almost as great as that of the vacuum tube over the relay. A transistor can switch flows of electricity as fast as the vacuum tubes used in computers, but the transistors use much less power than equivalent vacuum tubes, and are considerably smaller. With the transistor came the possibility of building computers with much greater complexity and speed than was considered even remotely possible just 10 years before.

The integrated circuit constituted another major step in the growth of computer technology. Until 1959 the fundamental logical components of digital computers were the individual electrical switches, first in the form of relays, then vacuum tubes, then transistors. In the vacuum tubes and relay stages, additional discrete components such as resistors, inductors, and capacitors were required in order to make the whole system work. These components were generally each about the same size as packaged transistors. Integrated circuit technology permitted the elimination of some of these components and "integration" of most of the others on the same chip of semiconductor that contains the transistor. Thus the basic logic element — the switch, or "flip-flop", which required two separate transistors and some resistors and capacitors in the early 1950s, could be packaged into a single small unit in I960. The chip was a crucial development in the accelerating pace of computer technology.

РАЗДЕЛ ПЯТЫЙ

Основной текст: Microprocessors: a Brain to the Hardware.

Грамматические явления: Средства выражения модальности.

Лексические явления: Контекстуальное значение слов: set, time, times. Перевод слов с префиксами: mis-, re-.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ
(ЗАНЯТИЕ ПЕРВОЕ)

Проверьте, знаете ли вы следующие слова.

1) instruction n, series n, compact a, coordinate v, mobility n, lock n, basic a, monolithic a

2) tremendous c, available a, gain v, application n, concept n, improve v, rapidly adv, extensive a, effort n, widen v, need v, include v, hardware n, software n, reasonable a, define v, relatively adv, advantage n, distribute v, capability n, flow n

Ознакомьтесь с терминами Основного текста.

1. random access memory - ЗУ с произвольной выборкой
2. read-only memory — постоянное ЗУ
3. peripheral interface circuit — интерфейсная схема
4. timing circuit — синхроцепь
5. power supply — источник питания
6. control panel - пульт управления
7. instruction manual - сборник инструкций
8. service routines — обслуживающие программы
9. interrupt unit - блок прерывания
10. register array – регистр

ОСНОВНОЙ ТЕКСТ

1. Переведите первую часть (I) Основного текста в аудитории под руководством преподавателя.

2. Просмотрите вторую часть (П) Основного текста и кратко изложите по-русски ее содержание.

MICROPROCESSORS: A BRAIN TO THE HARDWARE

I. The microprocessor forms the heart of a microcomputer.

The first microprocessors were developed in 1971 as an offshoot[1] of pocket calculator development. Since then there has been a tremendous upsurge[2] of work in this field and some years later there appeared dozens[3] of different microprocessors commercially available.

The age of the microprocessor is not great. Yet, we have seen the evolution of the microprocessor as it progressed from early applications in simple hand-held calculators through 4- and 8-bit controller applications towards more sophisticated processing operations.

Microprocessors are used primarily to replace or upgrade[4] random[5] logic design.

By taking advantage of the knowledge and concepts gained in mainframe and minicomputer applications better and more sophisticated microprocessors are beginning to emerge. What we see are: larger and denser chips; higher resolution; higher speed; specially designed RAMs (random access[6] memory) and ROMs (read-only memory); specially designed I/O and peripheral[7] interface circuits; on-chips clock and timing circuits; more extensive and more powerful instruction sets[8] and lower power dissipation.[9]

With the enormous efforts now directed to MPs, performance will improve rapidly. A far larger number of bits (higher resolution), higher speeds, more extensive and more powerful instruction sets, and elimination[10] of non-LSI components have come. In addition, software for these machine would also evolve into more standardized forms.

Microprocessors are now appearing in many types of equipment and their field of application will inevitably[11] widen.

Since these devices are likely to be used by the million in the near future, it is reasonable to ask what a microprocessor is, how it can be used and what its future impact[12] will be.

As mentioned before computer actually refers to a computing system including hardware (processor, I/O circuits, power supplies,[13] control panel, etc.) and software (instruction manual, user's manual, assembler, and diagnostic and service routines). Processor is known to refer to the processing circuits: central processing unit, memory, interrupt unit, clock, and timing.[14] Most processors also include computer software.

Central processing unit (CPU) —heart of the processor — consists of the register array, arithmetic and logic unit, control unit (including micro-ROM), and bus[15] control circuits. Micro software may also include: microinstruction manual, micro assembler, etc.

Mini — has been used with computers and refers to the systems having mainframe only, no peripherals.

Micro —can refer to computers, processors, or processing units. Smaller size and lower cost are usually obtained through use of LSI circuits.

Monolithic — generally implies[16] a single block or chip of silicon. A monolithic CPU is therefore a single-chip CPU, produced with LSI techniques. The term monolithic processor eliminates the need to differentiate[17] between mini and micro. The acronym MP can represent either micro of monolithic processor.

Any processing unit has a logic and a control unit. Broadly speaking, a control system can be defined as an element or series of elements that implement the transformation of a physical input excitation[18] into a corresponding[19] physical output response in some deterministic manner. The logic element is an integral part of any control system. The logic element is known to be the basic component of all computers. A great deal of effort has been directed towards reducing the size of the basic logic element.

The very first microprocessors were fabricated using PMOS technology. These were, however, relatively slow devices principally because "holes" in the p -type material have a low mobility. Later, improved technology permitted microprocessors to be constructed using n-type MOS and these microprocessors are almost as fast as normal minicomputers with speeds of three or four microseconds per instruction. Some microprocessors are now made using CMOS. The speed and logic density of CMOS are inferior[20] to n-type MOS but the process does have some significant advantages. First of all, it has a low power consumption since power is only consumed when a logic element changes a state. Secondly, it can operate over a wide voltage range.[21] As a result, electronics based on CMOS can operate successfully with "noisy" power supplies and the low consumption makes it quite feasible[22] to use a simple battery to maintain the security[23] of supply for several weeks. This type of microprocessor has clear advantages over the other types if it is intended for use in exacting[24] or inaccessible environments. Further development should improve the logic density of CMOS and it is likely to become a dominant technology in the microprocessor field.

The only cloud on the CMOS horizon comes from a new development of the normal bipolar circuit. A new semiconductor configuration called integrated injection logic (IIL) has been devised[25] which eliminates the need for any resistors, capacitors or transistor isolation. This enables an extremely compact logic circuit to be formed which has a low power consumption while maintaining the normal speed of transistor-transistor logic (TTL).

The bulk of present-day microprocessor and memory logic is implemented using PMOS and NMOS processes, since these processes are now well developed and offer good logic density. In the future IIL and CMOS are likely to become the most popular types, and the general trends in technology indicate that lower power consumption, higher speeds and improved logic densities can be confidently anticipated.[26]

The key features to consider in any microprocessor are: word[27] length; architecture; speed; programming flexibility, etc. Word length should be the first feature to consider. The processor handles binary data in the form of "words". A word is a set of binary bits which is used to represent a binary number within the computer. It is the number of bits in the computer "word" which limits the numerical range of the data that the processor can handle. Microprocessors are structured for fixed word length or for modular expansion by a parallel combination of building-block chips.

The versatility of the microprocessor has altered the entire architecture of modern computer systems. No longer[28] is the processing of information carried out only in the computer's central processing unit. Today there is a trend towards distributing more processing capability throughout a computer system, with various areas. For example, an input-output port may have a controller to regulate the flow of information through it. At times the controller may accept commands from the CPU and send signals back in order to coordinate its operations with those of the rest[29] of the system; at other times the controller may operate independently of the CPU.

II. Distributing microprocessing is a technique in which the main microprocessor of the PC directs other microprocessors throughout the PC system to perform specific functions for it and report their status.

New forms of I/O are also acquiring[30] sophisticated capabilities with distributed microprocessing. These "intelligent" I/O modules perform some of the calculations formerly done by the main microprocessor, store information temporarily,[31] and do other functions under the direction of the main microprocessor.

Some remote I/O modules have microprocessors resident[32] in the modules. Remote I/O modules use the resident mic processors to shorten the effective scan time. However, with independent intelligence[33] in the I/O, if something happens to the PC, the I/O module might already have acted on misinformation. Hence, I/O modules with a resident microprocessor should include appropriate[34] instructions for fail-safe shutdown[35] should the PC develop a fault.[36]

A trend that is beginning to emerge in microprocessor design is the incorporation of troubleshooting[37] aids heretofore (до сих пор) available only on larger computers.

Provisions[38] can and are being made in the architecture. Whereas early developments were concerned with implementation of simple architectures with fundamental concepts and operations, the technology has now advanced to the point where significantly more sophisticated hardware can be (and is being) implemented in current and future microprocessor generations. For example, some relatively new functions available in today's PC's may include: Moving blocks of data from memory location to memory location or from I/O location to memory location with a single instruction; Matrix operations such as logical AND and logical OR for comparing on/off bit patterns; Expanded mathematical abilities. Most PCs have double precision arithmetic.

The ease or difficulty with which each element can communicate with another will affect how much the data are manipulated before they are transmitted through the network. The major obstacle to designing an effective distributed-processing system is the difficulty involved in writing the system's software, which must enable the various elements of the network to operate and interact efficiently.

There is a crucial[39] need for easy methods of documenting programs and changes made to them.

Programmabffity- that flexible feature not found in random-logic designs — can be obtained in microprocessors on one of two levels. A very detailed level of control is provided at the micro-instruction level. These micro-instructions may be used to obtain a macro, or machine-language, instruction set, which is then used to write control programs for microprocessor. New machine-language instructions may be defined by coding new microroutines. In this way an instruction set can be tailored to an application. Control programs can also be written in microcode. This provides increased execution speed and more detailed control at the expense of more difficult programming. Microprocessors that are not microprogrammable contain fixed, general-purpose instruction sets, that are often adequate[40] for most applications.

Users have long felt a need to have a means of automatically adding comments and explanations to a hard copy of user program. With the high-level language's code format and programming capabilities, this need is reaching a critical point.

The use of microprocessors makes systems easier operate and maintain. Microprocessors provide greater application flexibility. Today microprocessors are designed with communications in mind so it is possible to link these processors together in a network. It is attractive for a number of reasons.

We can look forward to even more sophisticated system functions including digital to analog conversion[41] and vice versa, more arithmetic capability such as matrix inversion, etc., and massive amounts of memory.

Проверьте, как вы запомнили слова.

5.1. Переведите следующие слова, исходя из значений слов, приведенных в скобках:

1. random a (случайный), randomly adv; 2. dissipation n (рассеяние), dissipate v; 3. elimination n (исключение), eliminate v; 4. supplies n pl (поставки), supply v; 5. manual a (ручной), manually adv; 6. excitation n (возбуждение), excite v; 7. security n (безопасность), secure a; 8. anticipate v (предвидеть), anticipation n; 9. fault n (ошибка), faultless a

5.2. Определите значения английских слов, исходя из контекста:

1. новые типы компьютеров начали emerge; 2. access к ячейкам памяти стал возможным; 3. подается a set of команд; 4. dissipation of энергии должно быть как можно более низким; 5. область применения компьютеров inevitably расширяется; 6. возрастает impact of компьютеров на многие области науки и промышленности; 7. все лишние компоненты должны быть eliminated; 8. для работы любая машина должна иметь power supplies; 9. термин «монолитный» implies единый блок; 10. необходимо differentiate мини- и микрокомпьютеры; 11. новая технология permits конструирование микропроцессоров; 12. известно четыре states вещества; 13. при любой химической реакции должна быть обеспечена security, 14. необходимо anticipate будущие последствия; 15. новые полупроводники have been devised; 16. работа is shared равномерно; 17. команды всегда

должны быть appropriate; 18. to spread влияние; 19. fault любого компонента может вывести машину из строя; 20. в микропроцессоре должны быть предусмотрены troubleshooting средства

5.3. Переведите следующие слова. Обратите внимание на значение префиксов mis- означает неправильность; re-— повторность.

mis-: misapply v, miscalculate v, misdirect v, mishandle v re-: react v, reuse v, rearrange v, relocate v, replace v

Обсудите содержание текста.

5.3. Просмотрите первую часть (I) Основного текста еще раз. Ответьте на вопросы, используя информацию текста:

1. What is a microprocessor? 2. When was the first microprocessor developed? 3. What are the advantages of microprocessors in comparison with random-logic design? 4. What does a typical microprocessor consist of? 5. What are the current trends in the development of microprocessors? 6. What is pro-grammability? 7. Why is the integration of more functions on a chip important?

5.4. Дайте определения следующих понятий:

1. a processor; 2. a microprocessor; 3. a minicomputer; 4. a microcomputer; 5. random-logic design; 6. an instruction set; 7. a word; 8. programmability, 9. a distributing system

5.5. Обобщите информацию, данную в тексте (I часть):

1. Что вы узнали о микропроцессорах; об истории их развития? 2. Каковы перспективы их развития? 3. Чем они отличаются от процессоров? 4. Что означает английское сокращение MP? 5. Как создавались первые микропроцессоры? 6. Что означают термины PC? integrated injection logic? programming flexibility?

5.6. Бегло просмотрите вторую часть (II) Основного текста. Сообщите, что вы узнали о:

1. distributing microprocessing; 2. "intelligent" I/O modules; 3. fail-safe shutdown; 4. troubleshooting aids; 5. relatively new functions available in today's PCs; 6. advantages of distributing processing; 7. the major obstacle to designing distributed-processing system; 8. programmability

Проверьте, как вы умеете переводить различные средства выражения модальности.

5.7. Переведите речевые отрезки, глагол-сказуемое которых выражает ту или иную степень необходимости совершения действия:

1) 1. the amount must be reached; 2. there must be a close relation; 3. the problem of consumption should be considered; 4. the task is to be executed in tune; 5. the information has to be distributed equally; 6. the sign needs interpretation; 7. How is the phenomenon explained?

2) 1. It is necessary that the measurement should be accurate. 2. New data make a special test be introduced. 3. The image is bound to be interpreted.

5.8. Переведите речевые отрезки, глагол-еказуемое которых выражает ту или иную степень возможности совершения действия:

1) 1. What sort of life might exist in our solar system? 2. The scientist may choose any method of research. 3. The results can be reprocessed. 4. The error could appear. 5. The task would be solved.

2) 1. The concept is likely to be erroneous. 2. The fact cannot be denied. 3. One would expect the implementation.

Учитесь читать и переводить.

Текст 5.1. Прочитайте текст. Скажите, что вы узнали о: a distributed-processing network; the organization of dlstributed-processing systems.

Microelectronics in Data-Processing

In many computer systems today a number of processors are connected together to form a distributed-processing network. Most commonly the network consists of a number of minicomputers, but mainframe computers and microcomputers can also be incorporated into it. Input-output ports and data-transmission hardware are considered an active part of the network only if they are able to process information. Parts of a task are distributed among the elements of the network. Each element works inde- pendently for some period of time, communicating as necessary 1 with other elements.

Distributed-processing systems can be organized in several ways. A large distributed-processing system can be organized into a hierarchical structure. At the top of the hierarchy is asingle mainframe computer that communicates with processors in the network at a secondary level, which in turn can communicate with other processors on a tertiary level and so on. In a pure hierarchy the processors on any particular level cannot communicate directly with one another. Instead communications must be routed through the next higher level.

Alternatively a distributed-processing system can be organized into a peer structure. All the computers are on the same level and communicate with one another on an equal footing. Except for very small networks, however, it seldom happens that every element in the network can communicate with every other element. Instead the hierarchical structure and peer structure can be com bined into a hybrid system in which the processors on a particular level can communicate with one another and with processors on the next higher level.

Текст 5.2. Переведите текст письменно без словаря. После перевода озаглавьте текст. Дайте обоснование выбору заголовка. Значения выделенных слов вы сможете понять из контекста.

Microprocessors were the first step toward the introduction of logic devices and it will be possible within a few years for a current large-size processor with about one hundred thousand gates to be produced on a single chip by way of VLSI technology. Such a possibility will undermine conventional computer technology which has advanced via (посредством) the effective utilization of simple logic (circuits) serving as a central standard for evaluation. Stated otherwise, a technological foundation is in the process of being matured which will allow computers totally different from those existing today, something similar to artificial brains, to appear.

On the one hand, individuals will be able to have personal computers which are comparable in functions and performance with present day large-size computers and, on the other hand, by reevaluating package systems of various functions which have thus far been considered impractical new computers having advanced functions and performance will make possible the opening of new fields of applications.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ПЕРВОГО ЗАНЯТИЯ)

Изучите следующие гнезда слов и словосочетаний.

1. offshoot n отрасль; ветвь
2. upsurge n увеличение, рост; подъем
3. dozen n множество, масса
4. upgrade v повышать качество (продукции)
upgrade n подъем
uograde adv вверх
5. random a случайный; произвольный
at random наугад
6. access n 1. доступ; 2. подход
accessible a 1. доступный; 2. достижимый
accession я доступ
7. peripheral в периферийный; краевой
peripheral support circuit периферийная ИС
periphery n край
8. set n 1. набор, комплект; 2. ряд, серия; 3. прибор, установка
crystal set детекторный приемник
fault set набор неисправностей
instruction set набор команд

microprocessor set микропроцессорный комплект
tool set комплект приспособлений
set v 1, помещать; ставить; 2, устанавливать, учреждать; 3.выдвигать; 4. приступать
9. dissipation n рассеяние (мощности, энергии)
dissipator n тепловод, радиатор
10. elimination n 1. исключение, снятие; 2. подавление
eliminate v 1. устранять, исключать; 2, уничтожать, ликвидировать; 3. удалять; выделять
11. inevitably adv несомненно
inevitable a неизбежный
12. impact n 1. влияние, воздействие; 2. удар
13. supply n 1. питание, подача; 2. запас
supplies n pl 1. поставки; 2. питание, снабжение
power supply блок питания
in good supply в большом выборе
supply v снабжать; подавать
14. timing n распределение по времени
time n 1. время; 2. период;
раз time-consuming в 1. длительный; 2. трудоемкий
time v синхронизировать, хронировать
response time время срабатывания; постоянная времени
run time время прогона программы
storage time время хранения
timer n 1. синхронизирующее устройство; 2. реле времени, таймер
15. bus n 1. шина; 2. канал (информации)
16. imply v подразумевать, значить
implicit a подразумеваемый, неясный
implication n 1. гипотеза; 2. скрытый смысл
17. differentiate v различать(ся), отличать(ся)
differential с дифференциальный
18. excitation n возбуждение
excite v возбуждать; побуждать
19. corresponding a соответственный, соответствующий
correspond v соответствовать
correspondence n соответствие
20. inferior с плохой, худший; низкий
superior a лучший, высшего качества
inferiority n более низкое качество
21. range n 1. диапазон; 2. ряд; 3. сфера
22. feasible в возможный
23. security n надежность; безопасность
data security защита информации
system security безопасность работы системы
24. exacting я требовательный, взыскательный
exact a точный
exact v требовать
25. devise v придумывать, изобретать
devisable a то, что можно изобрести
26. anticipate v предвидеть
anticipation n предвидение, ожидание
27. word n слово
binary word слово в двоичном коде

code word ключевое слово, дескриптор
computer word машинное слово
wording n формулировка; текст
28.no longer больше не
long a 1. длинный; 2. долгий
long adv 1. долго; 2. давно
29. (the) rest n оставшаяся часть; остальные
rest n опора
rest v 1. опираться; 2. покоиться, лежать
30. acquire v приобретать; достигать; овладевать
acquirement n приобретение
31. temporarily adv временно
temporary a временный
32.residents зд. свойственный, присущий
33. intelligence n сведения, информация
34. appropriate a подходящий, соответствующий
35. shutdown n прекращение работы
36. fault n 1. недостаток; 2. авария, повреждение
faultless a безупречный
37. troubleshooting n выявление неполадок; отыскание и устранение неисправностей
trouble n неисправность
trouble-free a безотказный
38. provision n 1. обеспечение; 2. положение, условие
provide v обеспечивать; снабжать
39. crucial a 1. решающий; 2. критический
40. adequate a 1. соответствующий; 2. достаточный; 3. пригодный, отвечающий требованиям
adequately adv соответственно
41. conversion n превращение, преобразование
convert v превращать, преобразовывать
conversely adv наоборот, в противоположность
converter n преобразователь
image converter формирователь видеосигнала
interface level converter интерфейсная ИС

Проверьте, как вы запомнили выделенные слова.

(1 —10) the offshoot of PC development, dozens of different microprocessors; to upgrade random-logic design; peripheral interface circuits, instruction sets; lower power dissipation; elimination of non-LSI components

(11-20) the application will inevitably widen; the microprocessor impact, to have power supplies, bus control circuits, the term "monolithic" implies, to differentiate between mini and micro, an input excitation, a corresponding output response, logic density of CMOS is inferior to n -type MOS

(21 — 30) the security of supply, to anticipate the improved logic density, the rest of the system, to acquire capabilities

(31 — 41) to store information temporarily, appropriate instructions, to develop a fault

Задания к Основному тексту.

5.9. С целью проверки понимания первой части (I) Основного текста а) Запишите кратко содержание текста с помощью предикативных групп, например:

were developed, has been a tremendous upsurge of work, are beginning to emerge, etc.

б) Найдите в тексте английские эквиваленты следующих речевых отрезков:

1. на рынке появились десятки различных типов микропроцессоров; 2. более сложные операции по обработке; 3. большие усилия направлены на разработку

микрокомпьютеров; 4. область применения микропроцессоров расширяется; 5. логический элемент —неотъемлемая часть любой системы управления; б. процессор обрабатывает двоичные цифры; 7. изменилась архитектура микропроцессора

в) Составьте план краткого изложения содержания текста на английском языке. При изложении используйте следующие выражения:

were used; efforts are directed; are likely to be used; further development improves; it permits; is intended for; will bring about; the idea is sound

5.10. Устно переведите вторую часть (П) Основного текста.

5.11. Письменно в виде аннотации изложите по-русски содержание второй части (II) Основного текста.

5.12. Подготовьте 10 — 15 вопросов по содержанию Основного текста.

Проверьте, сможете ли вы перевести.

5.13. Переведите, учитывая средства передачи модальности:

1. Before discussing the patterns themselves it is necessary to examine factors which are likely to interfere with the results. 2. In order to shorten the time required to perform instructions, it is desirable to perform as many operations as possible in parallel. 3. Provision is made to complete computers for all initial boundary conditions to be applied. 4. Human needs and conventions have to be identified first and then converted to programs in the best possible way. 5. Sometimes the microcomputer system is to be used as a general purpose computer. 6. Engineers must deal with the evolution of the existing systems as well as the design of new systems. 7. Properly designed information systems might be viewed as black boxes. 8. The computer has made it possible to mechanize much of the information interchange and processing that constitute the nervous system of our society. 9. Architectures should provide adequate flexibility to support the growing trend to distributed systems. 10. Information systems grow and new ones are continuously added. The architecture must support such growth.

Учитесь читать и переводить.

Текст 5.3. Прочитайте текст и подготовьте сообщение об истории и перспективах развития вычислительной техники в СССР.

Is There an End to the Computer Race?

Computers capable of performing billions of operations a second are required for nationwide management of the economy. It was demonstrated by the prominent Soviet scientist, Academician Victor Glushkoy.

Together with his teacher, Academician Sergei Lebedev, and other scientists, he suggested ways to achieve such computer speeds. Nature also suggested what path to follow — the scientists succeeded "only in understanding it. At a congress in Stockholm in 1974 they shared their ideas with colleagues from other countries. Since then the work on supercomputers has gained pace in all laboratories and design offices.

They are different from ordinary computers primarily, as specialists put it, in architecture. The ordinary computer does the computations sequentially—operation by operation, while the supercomputer operates like brain: all the computations proceed concurrently. A major problem, roughly speaking, is split up into minor ones, and individual parts of the computer, the processors, do the computations simultaneously. During the activities (if required) and at the end of them the computation results are "drained". This can be roughly compared with a tank from which water previously flowed out by one pipe and then from a multitude of pipes — so the tank empties out much faster.

Qualitatively new integrated circuits were required to develop such a computer. They are now the basic component of the Soviet Elbrus supercomputers. It is a whole family of superhigh-capacity machines computing at a speed up to 125 million operations a second. The computation speed is even ten times as fast with a number of special operations.

In the next few years the team is to complete the work on computers with a capacity of above one billion operations a second. It will take a few more years to produce computers with a speed of over 10 billion operations a second. The road to electronic giants is open: fifth-generation computers performing 100 billion operations a second are likely to become available in the foreseeable future. Is there an end to this relay race?

According to an American researcher, we are close to what can be regarded as a true physical limit.

Other specialists regret the sluggishness of electrons. In their opinion, photons — light "particles" — will permit the performance to be made a thousand times faster.

This would mean that in the future we can expect the emergence of photon computers and that computations will be done by means of light. At least this is what is being hypothesized at present. The most daring futurologists predict that it will take place even before the year 2000. Well, that's not so far away! The race goes on...

5.14. Расскажите о возможностях применения компьютеров. Укажите новые возможности применения компьютеров с появлением микропроцессоров. Продолжите приведенный перечень.

Computer application development in the U.S.S.R.

1951 Scientists application (MESM) 1953 Math tables (BESM)

1954 First public computing service (STRELA)

1956 Language translation experiments (BESM)

1957 Economic calculation (M-2)

1958 Medical application (STRELA) 1961 Process control (DNEPR) 1964 Bank office (URAL)

1966 Chess program (M-220)

1977 Plant management information system (MINSK-22)

5.15. Расскажите о направлениях совершенствования компьютеров, используя модель:

To improve the computer its (reliability) should be increased as/since the greater the (reliability), the better the computer.

price (lower); size (make less); weight (decrease); accuracy (improve); flexibility (increase); sensitivity to temperature (decrease); reading error (eliminate)

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ
(ЗАНЯТИЕ ВТОРОЕ)

Проверьте домашнее задание.

5.16. Ответьте развернуто на следующие вопросы:

1. What is the function of the microprocessor? 2. What are the advantages of microcomputers in comparison with random-logic design? 3. What technology made the smaller size and lower cost of electronic devices possible? 4. What are the main factors resulting in greater cost savings of electronic devices? 5. What limits the numeric range of data the processor can handle? 6. What features of microprocessors are to be considered when dealing with their applications?

Определите контекстуальное значение выделенных слов.

5.17. Переведите, обращая внимание на контекстуальное значение слов set, time, times:

1) 1. The relationship must be set properly. 2. Industrial research in materials faces a different set of problems. 3. The microprocessor has a sophisticated instrument set. 4. This interface sets board dimensions.

2) 1. Computing time was a little more than five times longer than that required for a single iteration of the gradient procedure. 3. The problem of timing is very important as information is being

read into and put of the flip-flops at the same time. 4. The complete photoresist process must be repeated each time the silicon oxide is selectively removed. 5. Although improvements will reduce the required computation times, emulation will nevertheless be restricted to real time systems having slow response times.

Учитесь читать и переводить.

Текст 5.4. Прочитайте текст. Назовите рассматриваемые в тексте темы. Озаглавьте текст.

A microprocessor is a tool that deals with memories by reading and writing process. At first sight it is all it can actually do.

One can consider that it is surprising how a computer can answer a question only by dealing with O and 1 but the fact is that it works.

Only human brain can teach a computer how to "listen" to a question and "elaborate" an answer only by dealing with O and 1. A microprocessor is the next step, dealing with memories in complete "traditional" 8 bit bytes.

So the microprocessor is addressing a memory, a location inside the selected memory, and then achieves a read or write operation.

Additional tools have been designed to allow exchanges with external memories or devices.

First of all an address bus, for instance 16 bits allowing a selection of 1 word among 65.000. Then comes the data bus, generally 8 bits allowing read or write operation in the selected location of the memory. At last comes the control bus, for instance including memory read or write and I/O read or write, giving 4 wires the indication of the type exchange and the position of the receiver, inside or outside the system.

Текст 5.5. Бегло прочитайте текст и найдите информацию о секционных микропроцессорах. Переведите текст письменно.

Present microprocessors vary in their detailed architecture depending on their manufacture and in some cases on the particular semiconductor technology adopted. One of the major distinctions is whether all the elements of the microprocessor are divided among several identical modular chips that can be linked in parallel, the total number of chips depending on the length of the "word" the user wants to process: four bits (binary digits), eight bits, 16 bits or more. Such a multichip arrangement is known as a bit-sliced organization. A feature of bit-sliced chips made by the bipolar technology is that they are "microprogrammable": they al low the user to create specific sets of instructions, a definite advantage for many applications.

Учитесь говорить.

5.18. Обсудите следующие темы:

1. The microprocessor has altered the architecture of modern computer systems. 2. The organization of a distributed-processing system.

5.19. Прочитайте текст и составьте схему, показывающую основные направления исследований по разработке электронных микропроцессорных схем обработки данных и управления. Используйте выделенные слова в качестве ориентиров.

The architectural research and development efforts are directed at integrated circuits, computer architecture, operating systems, and programming languages.

Integrated circuit researchers are examining complementary metal-oxide semiconductor (CMOS) design styles, the effects of scaling very large scale integration (VLSI) circuits and control and docking issues. Computer architecture researchers are studying multiprocessor address trace analysis, cache consistency, virtually-tagged caches, in-cache address translation, multi-level cache design, coprocessor interfaces, instruction delivery, hardware support, and floating-point implementations. Operating system researchers are investigating network file systems, network page servers, the effects of large physical memories on virtual memory implementations, and workload distribution. Programming language researchers are examining parallel garbage collection algorithms, techniques for specifying parallel programs, and methods of compiling parallel Lisp programs.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ВТОРОГО ЗАНЯТИЯ)

Учитесь читать и переводить.

Текст 5.6. Переведите текст письменно со словарем.

Software

The chips and other electronic elements and the various peripheral devices constitutes the computer's hardware. The hardware can do nothing by itself; it requires the array of programs, or instructions, collectively called software. The core of the software is an "operating system" that controls the computer's operations and manages the flow of information.

The operating system mediates between the machine and the human operator and between the machine and an "application" program that enables the computer to perform a specific task.

To understand the kind of tasks done by the operating system, consider the sequence of steps that must be taken to transfer a file of data from the primary memory to disk storage. It is first necessary to make certain there is enough space available on the disk to hold the entire file. Other files might have to be deleted in order to assemble enough continuous blank sectors. For the transfer itself sequential portions of the file must be called up from the primary memory and combined with "housekeeping" information to form a block of data that will exactly fill a sector. Each block must be assigned a sector address and transmitted to the disk. Numbers called checksums that allow errors in storage or transmission to be detected and sometimes corrected must be calculated. Finally, some record must be kept of where the file of information has been stored.

If all these tasks had to be done under the direct supervision of the user, the storage of information in a computer would not be worth the trouble. Actually the entire procedure can be handled by the operating system; the user merely issues a single command, such as "Save file". When the information in the file is needed again an analogous command (perhaps "Load file") begins a sequence of events in which the operating system recovers the file from the disk and restores it to the primary memory.

Учитесь говорить.

5.20. Подготовьте сообщение об основных направлениях применения микропроцессоров, используя данный ниже план:

1. The application of microprocessors into control systems, particularly for vehicles.
2. The application into manufacturing systems and the means of production, which may include instruments as well as control devices.
3. The inclusion of microprocessors in the consumer goods to be produced.
4. The use of computer-based systems to design or manufacture, usually referred to as CAD/CAM.
5. Robot machines.

РАЗДЕЛ ШЕСТОЙ

Основной текст: New Developments in Electronic Memories.

Грамматические явления: Инверсия. Сложное дополнение с инфинитивом.

Лексические явления: Контекстуальное значение слов turn, challenge.

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ (ЗАНЯТИЕ ПЕРВОЕ)

Проверьте, знаете ли вы следующие слова.

1) exploitation и; associate v; visual a; analogue n; identical a; hierarchy n; approximately adv; series n; serially adv; universally adv; extremely adv; radically adv

2) capability n; intermediate a; sufficient a; involve v; virtually adv; refer to v; digital a; record v; rate n; define v; in terms of prp; access n; transfer v; possess v; suitable a; benefit n; emerge v; af-fect v; goal n; array n

Ознакомьтесь с терминами Основного текста.

1. digital information — цифровая информация
2. read/write memory — постоянная память, допускающая и считывание и запись
3. storage capacity — емкость памяти
4. random-access memory — ЗУ с произвольной выборкой
5. serial access memory —ЗУ с последовательной выборкой
6. a grid of wires — сетка токопроводящих дорожек
7. tunnel-junction devices — сверхпроводящие приборы с туннельным переходом
8. binary-coded address - адрес в двоичном коде
9. read-only memory —ПЗУ
10. shoe-box device —шубокс —устройство для непосредственного ввода цифр в машину голосом

ОСНОВНОЙ ТЕКСТ

1. Переведите первую часть (I) Основного текста в аудитории устно под руководством преподавателя.

2. Просмотрите вторую часть (П) Основного текста. Кратко изложите по-русски, что вы узнали об основных направлениях развития типов памяти.

NEW DEVELOPMENTS IN ELECTRONIC MEMORIES

I. The versatile capabilities that have made the computer the great success of our age are due to exploitation of the high speed of electronic computation by means of stored programs. This process requires that intermediate results be stored rapidly and furnished[1] on demand for long computations, for which high speed is worthwhile[2] in the first place.

Storage devices or memories[3] must have capacities[4] sufficient not only for intermediate results but also for the input and output data and the programs.

Once prepared a program can be reused any number of times, which involves remembering.

Computers can "remember" and "recall"[5] and virtually unlimited is the capacity of computers to remember (that is, to store information). Associated with the capacity of remembering is the capacity of recalling.

In the context of electronics "memory" (or, in British usage, "store") usually refers to a device for storing digital information. Storage ("write") and retrieval ("read") operations are completely under electronic control. The storage of auditory or visual information in analogue form is usually referred to as recording.

There is some overlap[6] between analogue and digital recording. Described here is digital memory.

The most widely used digital memories are read/write memories, the term signifying[7] that they perform read and write operations at an identical or similar rate.

Of primary importance to characteristics for memories are storage capacity, cost per bit and reliability. Other important characteristics are speed of operation (defined in terms of access time), cycle[8] time and data-transfer rate. Access time is simply the time it takes to read or write at any storage location.

The demand for fast access and large capacity has grown constantly. Never before has man possessed a tool comparable to a computer. Today there are memories accessible in tens of nanoseconds and memories with more than a billion bits. However although the existence of computer was a reality, only in 1970s have we got a microprocessor. It is the microprocessor that helps to solve many problems.

Ideal would be a single device in which vast amounts of information could be stored in non-volatile form suitable for archival record-keeping and yet be accessible at electronic speeds when called for.[9] So far[10] there is no way to realize this ideal. Fortunately, the benefits of large capacity and rapid access can be obtained by use of a hierarchy of different types of storage devices of decreasing capacity and increasing speed.

A prime distinction[11] between memories is the manner[12] in which information is stored (written) and accessed (read). Random-access memories involve column[13] and row[14] matrices which allow information to be stored in any cell[15] and accessed in approximately the same time. By contrast,[16] "serial access" means that information is stored in column order, and access time depends on the storage location selected.

The main hierarchy today comprises, on the one hand, large-capacity magnetic recording devices, which are accessed mechanically and serial (reels[17] of tapes, disks, and drums), and on the other hand, fast electronic memories (the core[18] memory and various types of transistor memories).

Random-access memories can complete read and write operations in specified minimum period known as the cycle time. Serial-access and block-access memories have a variable and relatively large access time after which the data-transfer rate is constant. The data-transfer rate is the rate at which information is transferred to or from sequential storage positions.

The smallest block of information accessible in a memory system can be a single bit (represented by 0 or 1), a larger group of bits such as a byte[19] or character[20] (usually eight or nine bits), or a word (12 to 64 bits depending on the particular system). Most memories are location-addressable,[21] which means that a desired bit, byte or word has a specified address or physical location to which it is assigned.[22]

Of prime interest to a reader will be the knowledge of the development of memories.

One of the first electronic memories was a circulating delay line, a signal transmission device in which the output, properly amplified and shaped, was fed back[23] into the input. Although it was economical, it had the inherent drawback[24] of serial access: the greater the capacity, the longer the average access time. What was really needed was selective access to any stored data in a time that was both as short as possible and independent of the data address or any previous access. This is known as random access, so named to emphasize[25] the total freedom of accessing and therefore of branching[26] (following one or another part of a program). The first random-access memories (RAM's) were electrostatic storage tubes.

In the early 1950's the core memory replaced these early devices, providing a solution to the need for random access that truly fired the emerging computer industry.

The core memory has become the main internal computer memory and was used universally until challenged[27] recently by semiconductor memories. Typical are memories with 1 million words of 30 to 60 bits each, randomly accessible in 1 microsecond. The core memory has also been extended to very large capacities, of the order of 100 million words.

In the 1950's and 1960's electronic memories were arrays of cores, or rings, of ferrite material a millimeter or less in diameter, strung[28] by thousands on a grid of wires. Ferrite-core memories have now been largely succeeded[29] in new designs by semiconductor memories that provide faster data access, smaller physical size and lower power consumption, and all at significantly lower cost.

In the early 1970's semiconductor memory cells that served the same purpose as cores were developed, and integrated memory circuits began to be installed as the main computer memory.

In the 1980's new memory technologies involving magnetic bubbles, superconducting tunnel-junction devices and devices accessed by laser beams or electron beams come into play.

Semiconductor memories are extremely versatile and highly compatible[30] with other electronic devices in both small and large systems and have much potential for further improvement in performance and cost. They are expected to dominate the electronic-memory market[31] for at least another decade.

The most widely used form of electronic memory is the random-access read/write memory (RAM) fabricated in the form of a single large-scale-integrated memory chip capable of storing as many as 65.000 bits in an area less than half a centimeter on a side. A number of individual circuits, each storing one binary bit, are organized in a rectangular[32] array. Access to the location of a single bit is provided by a binary-coded address presented as an input to address decoders that select one row and one column for a read or write operation. Only the storage element at the intersection[33] of the selected row and column is the target[34] for the reading or writing of one bit of information. A read/write control signal determines which of the two operations is to be performed. The memory array can be designed with a single input-output line for the transfer of data or with several parallel lines for the simultaneous[35] input or output of four, eight or more bits.

П. Different categories of semiconductor memories and specific data storage applications where they find primary use provide system engineers with a wide range of options.[36] In general, metal-oxide semiconductor (MOS), erasable-programmable readonly memories (EPROMs) and dynamic random-access memories (RAMs) are extensively used in micro- and minicomputer applications. The slow electrically-alterable read-only memories (EAROMs) are most suitable to peripherals, at present. In addition, dense dynamic MOS RAMs are used in large volume[37] in small and large mainframe computers, and so on and so forth. Many laboratories are looking for new options.

However, we are still far from the ideal shoe-box device with 10^{12} bits accessible in nanoseconds, and still farther from the capacities of 10^{15} bits needed for many already well-defined applications. Although much can still be expected from VLSI and magnetic techniques, these great goals (цель) may require radically new approaches.

Very high speed and very low power memories rather than large capacity may well be the benefits of some of these approaches.[38]

Thus computers today use a hierarchy of large-capacity, relatively slow mechanically accessed memories in conjunction[39] with fast electronically accessed memories of relatively small capacity. It would be highly desirable to fill the gap by some device of sufficient capacity and speed.

Candidates for gap-filling memories include metal-oxide semiconductor (MOS) random-access memories (RAMs) made by large-scale integration (LSI); magnetic bubble devices based on cylindrical domains of magnetization; electron beam-addressed memories; and optical memories based on lasers, holography, and electrooptical effects, charge-coupled devices (CCD).

One of the latest designs of a CCD serial-access memory has storage for 65.536 bits on a chip measuring about 3.5 by five millimeters.

The vast[40] number of different types of semiconductor memories available to the system engineer is increasing steadily.

Radically new technologies, still at an early laboratory stage, are aimed[41] at a more ideal solution than today's hierarchy.

Many laboratories are looking into basic principles. Semiconductor memories based on the Josephson effect may be able to operate in picoseconds on small power. The boundaries within the walls of magnetic domains,[42] exploited in the bubble lattice devices, are also used in a so-called cross-tie memory that may provide non-volatile storage memories on LSI chips.

One can foresee the development of cryoelectronic memories with extremely high component densities operating at speeds 10 to 100 times faster than today's fastest electronic memories.

Researchers now are looking forward to light particles — photons — which will permit the performance to be made a thousand times faster. This would mean that in the future we can expect the emergence of photon computers and that computations will be done by means of light.

Any radical improvement in memory technology will ultimately greatly affect our way of life, as previous innovations have shown.

Проверьте, как вы запомнили слова.

6.1. Переведите следующие слова, исходя из значений, приведенных в скобках:

1. store v (хранить), storage n; 2. capacity n (объем, емкость), capacitance n; 3. retrieve v (отыскивать), retrieval n; 4. overlap v (перекрывать, дублировать), overlapping n; 5. callv (вызывать), recall n; 6. distinction n (различие), distinct a; 1. contrast n (противоположность), by contrast; 8. address n (адрес, обращение), addressable a; 9. average a (средний, обычный), average v; 10. branching n (ветвление), branch и; 11. challenge n (проблема), challenging a;

12. succeed v (следовать), succession и; 13. option n (выбор), optional a; 14. approach n (подход), approach v; 15. innovation n (новшество), innovator n

Обсудите содержание Основного текста.

6.2. Просмотрите текст еще раз (I часть). Ответьте на вопросы, используя информацию текста:

1. What is a storage device? 2. What are the most important characteristics of memory? 3. What were the first electronic memories like? 4. What were their drawbacks? 5. What are the advantages of semiconductor memories? 6. What new memory technologies emerged in the 1980's? 7. What are research laboratories aimed at? 8. What is expected of a new generation of superfast computers?

6.3. Дайте определения следующих понятий:

1. memory; 2. core memory, 3. digital memory; 4. read/write memory, 5. random access memory; 6. serial access memory; 7. access time; 8. cycle time; 9. bit; 10. byte; 11. word; 12. address

6.4. Обобщите информацию, данную в тексте (I часть).

6.5. Бегло просмотрите вторую часть (П) Основного текста. Сообщите, что вы узнали о:

1. dense dynamic MOS RAMs; 2. radically new approaches; 3. candidates for new memories; 4. radically new technologies; 5. the fifth generation computers

Проверьте, как вы умеете переводить.

6.6. Переведите речевые отрезки и предложения, содержащие инвертируемые конструкции:

1. Not only were such controls difficult to arrange, they were.... 2. Not only does the number of protons determine the element, but it determines its chemical characteristics. 3. Of primary importance to science will be the knowledge obtained by sputniks. 4. Of primary interest are the so-called mesons. 5. Discussed in this paper are some of options of memories. 6. Shown in the photo is the equipment available. 7. Little though the probability of collision may be, the possibility still exists. 8. Difficult as it is to observe the phenomenon, it is far more difficult to obtain....

Учитесь читать и переводить.

Текст 6.1. Прочитайте текст. Скажите, что вы узнали о: CCDs, ferrite core memories, the bubble memory. Озаглавьте текст.

The solution to the memory problem in computers made a significant transition in the early 1950's with the development of ferrite core memories.

Magnetic ferrites being made of ceramic rather than metal were capable of providing a much shorter access time through electronic circuitry than the drums, tapes and discs which were based on metallic magnetics and mechanical access times. The gap between mechanical access times and electronic access time of the core is between 10^{-2} seconds and 10^{-5} seconds.

With the development of integrated circuits the first trend toward what is now called large scale integrated circuits or LSI was the development of scratch pad memories using bipolar transistors made in large quantities on one large substrate. This was followed almost immediately by the development of MOS random-access memories (RAMs) with 1 to 16K capacity. The access times to the bipolar memories are in the order of 1 to 10 nanoseconds and for MOS memories on the order of 100 nanoseconds.

More recently we have been able to return to the concept used years ago of the recirculating delay line by using charge transfer coupled devices in a shift register configuration which recirculates bits and is accessed in a serial fashion. Because of the serial access, access time is slower — of the order of 2 milliseconds with a data rate of one megahertz.

The bubble memory first described in 1967 is now a reality with the advantage of high capacity, of the order of 500 kilobits, but with the disadvantage of bit rates of a few hundred kilobits per second compared to the megabits per second possible in charge transfer devices.

All of these recent developments, the MOS, RAM, CCD, and bubble are in the gap between the mechanical access memories and the higher speed MOS devices and bipolar memories.

Текст 6.2. Переведите текст письменно без словаря. Значения выделенных слов вы сможете понять из контекста. Озаглавьте текст.

Some applications require random-access memories containing permanently stored or rarely altered information. For example, the control programs in pocket calculators are usually permanently stored. Such storage is provided by read-only memories (ROMs). Information is placed in the storage array when the chip is manufactured.

A read-only memory can be obtained by replacing the storage capacitor in a one-transistor memory cell with either an open circuit or a connection to ground, thus representing one or the other of the two binary states.

Текст 6.3. Прочитайте текст. Найдите в тексте ответы на следующие вопросы:

1. What is the read-mostly memory? 2. Which variations of read-mostly memories are referred to?

Another variation of the read-only memory is the read-mostly memory, which is desired when read operations are far more frequent than write operations but for which non-volatile storage is required.

Read-mostly memories have two forms. The commonest is the optically erasable (стираемая) read-only memory. This memory is read and written by entirely electronic means, but before a write operation all the storage cells must be erased to the same initial state by exposing the packed chip to ultraviolet radiation.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ПЕРВОГО ЗАНЯТИЯ)

Изучите следующие гнезда слов и словосочетаний.

1. furnish v 1. снабжать, обеспечивать; 2. предусматривать
furnishings я pl оборудование
2. worthwhile a стоящий; имеющий смысл
to be worth (while) иметь смысл, заслуживать внимание
3. memory n 1. память; 2. ЗУ
random-access memory (RAM) память с произвольной выборкой
add-on memory дополнительная память
backing memory резервная память
bubble memory память на ЦМД
4. capacity n 1. способность; 2. мощность; производительность; 3. емкость, объем, вместимость
in the capacity of в качестве
capacitance n емкость
capacitor n конденсатор
5. recall v воспроизводить; вспоминать
6. overlap(ping) n 1. параллелизм, дублирование; 2. повторение; 3. соединение внахлестку
overlap v 1. перекрывать(ся); накладывать(ся); 2. частично совпадать; 3. дублировать
7. signify v 1. означать; 2. иметь значение
8. cycle n 1. цикл; период; 2. такт; 3. круг
duty cycle рабочий цикл
memory cycle цикл работы ЗУ
operation cycle цикл выполнения работы ЗУ
9. call for требовать
call v называть
call n сигнал; вызов, запрос
10. so far cj до сих пор

11. distinction n 1. отличие, различие; 2. отличительная особенность; 3. известность
distinctive a отличительный, характерный
distinct a явный, определенный; ясный
distinctly adv отчетливо; ясно; определенно
12. manner n 1. способ, метод; 2. стиль
in the manner of наподобие, по методу
in a manner до известной степени; в некотором смысле
13. column n 1. столбик, столбец; 2. колонна
14. row n ряд
15. cell n 1. ячейка; 2.эл. элемент
16. contrast n противоположность
contrast v противопоставлять, сопоставлять
by contrast наоборот
17. reel n 1. рулон; 2. катушка; 3. барабан
reel v 1. разматывать; 2. качаться
reel-to-reel катушечный (магнитофон)
18. core n 1. ядро; сердечник; 2. внутренность
19. byte n байт Cp. bit n бит
20. character n 1. цифра; 2. символ; 3. характер; 4. качество, свойство
21. addressable a адресуемый, имеющий адрес
address n 1. адрес; 2. обращение
address v адресовать; направлять
22. assign v 1. назначать; определять; 2. закреплять
assignment n 1. назначение; 2. задание
23. feedback n 1. обратная связь; 2. результаты, материалы, полученные в одной области, но используемые в другой
feed v 1. питать; 2. подавать
24. drawback n 1. недостаток; 2. погрешность
25. emphasize v придавать особое значение; подчеркивать
26. branching n 1. ветвление; 2. ветвь алгоритма; 3. условный переход
branch n 1. ветвь; 2. отрасль; 3. филиал, отделение
branch v 1. ветвиться; 2. осуществлять (условный) переход
27. challenge v 1. бросать вызов; 2. оспаривать
challenge n 1. сложная задача, проблема; 2. возражение; 3. вызов
to accept the challenge браться за решение проблемы
to face the challenge столкнуться с проблемой
challenging a 1. интересный; 2. перспективный; 3. сложный; 4. смелый
to meet the challenge удовлетворять требованиям
to offer the challenge ставить задачу; открывать перспективу
28. string (strung) v 1. натягивать; 2. связывать,
string n 1. ряд; 2. строка; 3. последовательность
29. succeed v 1. сменять, следовать; 2. достигнуть цели
success n успех
succession n 1. последовательность; 2. непрерывный ряд
in succession подряд; последовательно
30. compatible a 1. совместимый; 2. сходный
compatibility n совместимость
31. market n 1. рынок; 2. сбыт, торговля; 3. цена, курс
32. rectangular с прямоугольный
rectangle n прямоугольник
33. intersection n 1. пересечение; 2. точка пересечения
intersect v пересекать(ся)

34. target n 1. цель; 2. задание; план
35. simultaneous одновременный; синхронный
simultaneously adv одновременно
36. option n 1. выбор; 2. вариант; заменитель
technology option технологический вариант
optional в произвольный; необязательный
37. volume n 1. объем; 2. множество
38. approach n 1. подход; метод; 2. приближение
approach v подходить, приближаться
approachable a доступный; достижимый
39. conjunction n 1. связь, соединение; 2. совпадение
in conjunction with вместе
40. vast a обширный
41. aim v иметь целью; стремиться
to be aimed at быть направленным; быть предназначенным
aim n цель, намерение
42. domain n 1. область, сфера; 2. домен

Проверьте, как вы запомнили выделенные слова.

(1 —10) due to the capacity; a due cycle; the capacity is due to the speed; to furnish the recall; the memory capacity; to signify some overlap between analogue and digital recording

(11 - 20) so far there is no way to realize an ideal reliability; there is a distinction between memories; to store information in any cell

(21 — 30) most memories are location addressable; a word is assigned to a special address; the inherent drawback of serial access; the output is fed back into the input; to emphasize the total freedom of accessing; a branch of science; to challenge the core memory, to succeed in a faster data access; semiconductor memories are compatible with other electronic devices

(31 — 42) individual circuits may be organized in a rectangular array; simultaneous operations; a wide range of memory options; to use memories in large volume in small and large mainframe computers; to require radically new approaches; to use slow mechanically accessed memories in conjunction with fast electronically accessed memories; vast amount of information; new technologies are aimed at a more ideal solution

Задания к Основному тексту.

6.8. а) Запишите кратко содержание текста с помощью предикативных групп; б) Найдите в тексте эквиваленты следующих речевых отрезков:

1. обусловлены применением высоких скоростей процесса вычислений; 2. программа может быть использована любое количество раз; 3. способность воспроизводить связана со способностью запоминать; 4. требования к быстрому доступу и емкости непрерывно возрастают; 5. идеальным могло бы быть устройство, в котором хранилось бы огромное количество информации в неизменном виде; 6. что позволяет хранить информацию; 7. у этой памяти есть присущий только ей недостаток; 8. новая технология памяти на ЦМД; 9. сигнал управления считыванием и записью определяет, какие из двух операций

в) Составьте план краткого изложения содержания первой части (I) Основного текста.

6.9. Устно переведите вторую часть (П) Основного текста.

6.10. Письменно в виде аннотации изложите по-русски содержание второй части (II) Основного текста.

6.11. Составьте вопросы всех типов по содержанию Основного текста.

Проверьте, сможете ли вы перевести.

6.12. Переведите предложения, учитывая средства и способы оформления инверсии:

1. Not only does the computer make the collection procedure easier but it makes feasible unattended data collection. 2. Should an error occur for any reason during the running of the program, the program terminates by indicating what the error number is and in which line it occurred. 3. Among the parameters studied was the composition of the starting material. 4. Had we to use the same number of vacuum tubes instead of transistors, our modern electronic systems would be wholly impractical.

Учитесь читать и переводить.

Текст 6.4. Прочитайте текст и запишите основную информацию о ЗУ. Выпишите ключевые слова, с помощью которых можно дать краткую характеристику ЗУ различных типов.

Memory

Memory is the predominant computer subsystem. The ideal memory is inexpensive, small in size, and large in capacity. It consumes little power and operates at the same speed as computer logic. Today, such a memory is a concept rather than a reality. Therefore, to provide optimum storage capability, computer designers have partitioned (разделять на секции) storage into many memories serving specialized purposes.

Read-only memories (ROM), write optional memories (WOM), and associative memories can be used extensively in medium and large family members — particularly in establishment of system management. Associative memories can be used for compiling, job assignment, parallel processing, search operations, handling of priorities and interrupts, and recognition of I/O commands.

Programmable logic arrays can perform many of the executive processes currently performed by software and can be used to tailor a system to meet particular user needs. These arrays and associative memories can replace operating system programs and be used to establish logical system organization.

Registers and discrete bit storage are used for temporary storage of data and instructions,.for implementing arithmetic and logic operations, and for memory addressing. These components are referenced frequently and operate at the same speed as computer logic. Registers of fourth generation computers are fabricated on a single monolithic chip.

High-speed scratch-pad and control memories are another stratum of storage hierarchy. These memories are also used for temporary storage of specialized data, including intermediate results of arithmetic operations, instructions, short subroutines which are repeatedly executed, frequently referenced data, and control functions. The speeds of these memories are not as fast as the speed of computer logic but are usually an order of magnitude faster than the speed of main memory. Capacities range up to 10^5 bits. Batch-fabricated, bipolar transistor arrays will predominate this area in the near future.

Текст 6.5. Переведите текст письменно со словарем. Время перевода —12 минут.

Magnetic Bubbles

The physical feasibility of magnetic bubbles has been proved. Bubbles can be created and destroyed, moved reversibly in two dimensions, magnetized for presence or absence of charge, and mutually repulsed to perform logic.

Micro-sized bubbles can be supported in magnetic rare earth garnets grown epitaxially on nonmagnetic matching substrates. Since the number of similar process strips is much fewer than for silicon, the cost per area should be lower. Shift registers 1000 bits long, at densities of 1.6M bits/in^2, should be routine. Mask size, not defect density, is the present size limitation.

Electron beam processing should benefit bubble technology: smaller bubbles for higher packing densities and lower costs should result.

Проверьте, знаете ли вы следующие термины.

6.13. Переведите данные термины:

1. add-on memory, 2. backing memory; 3. bubble memory, cache memory, 4. CCD memory, 5. content-addressable memory; 6. destructive memory; 7. erasable memory, 8. read-only memory; 9. general purpose memory, 10. high-density memory, 11. highspeed memory, 12.

mass (storage) memory, 13. metal-electric semiconductor memory; 14. off-chip memory; 15. on-chip memory, 16. power-down memory; 17. scratch-pad memory; 18. self-refreshing memory

6.14. Расшифруйте следующие сокращения: ROM, RAM, PROM, EPROM, EEPROM

МАТЕРИАЛЫ ДЛЯ РАБОТЫ В АУДИТОРИИ
(ЗАНЯТИЕ ВТОРОЕ)

Проверьте домашнее задание.

6.15. Ответьте развернуто на следующие вопросы:

1. What are the most important characteristics of memory? 2. What do you know about different types of memories? 3. What do you know about analogue and digital recording? 4. Can you compare random access memories and serial access memories? 5. What developments can be expected by the end of the century in the field of computer memories? 6. What is being done at present to improve memory capacity and speed?

Определите контекстуальное значение выделенных слов.

6.16. Переведите, обращая внимание на значение слова challenge:

1. Established ways of design and fabrication are being challenged today by newer techniques. 2. Since the early days of silicon technology, contacts between metal and silicon have presented a constant challenge to the electronics industry. 3. Technological breakthroughs are necessary to meet the challenges of programmable microelectronic products. 4. By far the greatest challenge in the language area will be to develop new and more powerful general-purpose languages. 5. Typical challenges include checking out and operating complex missile systems. 6. The challenge was to do the test carefully.

Учитесь читать и переводить.

Текст 6.6. Прочитайте текст. Определите его основную тему. Озаглавьте текст.

Josephson logjc and memory circuits make use of essentially conventional passive components and a rather sophisticated active device.

The two phenomena underlying the operation of the active devices are superconductivity and electron tunneling.

The first of these, superconductivity, discovered by Kammerlingh Onnes, was explained in detail by Bardeen, Cooper, and Schrieffer. All four received Nobel prizes in physics for their work. Electron tunneling received its first practical application with the invention of the semiconductor tunnel diode by Esaki in 1957. The second important tunneling discovery was that of superconductive tunneling by Giaever. Lastly, Josephson predicted that magnetic field-sensitive supercurrents should flow through a tunnel junction with a frequency proportional to the voltage across the junction. The tunneling discoveries of Esaki and Giaever and the predictions of Josephson led to a "tunneling" Nobel prize in physics, awarded in 1973.

That the superconductive tunnel junction, combined with a means of controlling the magnitude of the zero-voltage current, forms a fast, low-power logic and memory device was recognized in 1967 by Matisoo. Matisoo designed and fabricated such devices and established their static and dynamic properties in simple circuits.

Текст 6.7. Прочитайте текст. Составьте структурно-логическую схему типов памяти. Используйте также информацию Основного текста.

<u>Large Scale Integration; Memories</u>

There are a number of types of memory which can be used as ICs in digital electronics. These include

a. Random-Access Memory (RAM), wherein each memory word is accessed for reading or writing via a specific address, access time being approximately equal for any combination of successive locations.

b. Serial Access Memory (SAM), wherein the memory consists of a circular shift register (serial output connected to serial input). A counter keeps track of the "address" of the bit available for reading and writing (the serial output and input bits). To read or write a given address, the register is shifted until the counter matches the desired address: clearly a large change of address takes longer than a short one.

c. Read-Only Memory (ROM), in which the binary contents are wired in at the factory as a step in the IC manufacturing procedure. These act like RAMs, except it is not possible to change the contents. Although it is possible to obtain custom-designed ROMs, they are too expensive for production in small quantities.

d. Programmable ROMs (PROMs), which can be written using special equipment. These hold their contents until erased with high-intensity ultraviolet light and re-programmed.

e. Programmed Logic Arrays (PLAs), some of which can also be programmed, do not have a full-scale memory complement, but are an expensive way of making a ROM-like device, in which not all inputs codes correspond to defined outputs, and a given output can be specified by more than one input code.

RAMs are used for temporary data storage because they are volatile: that is their contents are lost if power is removed. ROMs, PROMs, and PLAs are non-volatile, but cannot be written on during normal operation.

A number of new memory types have recently appeared. We can expect corelike RAMs to become available in the near future.

RAMs, being used for temporary data storage, are good "scratch pads" for digital devices; they are used as computer memories for the full range of computer sizes, often in a mixture of ROM, RAM, and core memory.

ROMs and PROMs are used for permanent storage, such as the programs in microcomputers, and start-up programs in larger machines. They are also used to sequence sequential machines from one state to the next, and they are very useful for data conversion, table lookup (trigonometric tables, for example), and generation of complex logical functions. A PROM is used to test a new memory content: if it is correct, a ROM is manufactured with the same content if the number of devices or speed requirements (ROMs are faster) justify the expense; PROMs are used for slower devices produced in smaller quantities.

Учитесь говорить.

6.17. Прочитайте текст. Используйте информацию текста для беседы на тему «Надежность».

What mostly affects system performance is reliability: while increased speed may provide 5% more throughput (производительность) increased reliability significantly affects the system output. System reliability can be quantified by MTBF (mean-time between failures), which is the reciprocal (обратная величина)of the product of the device failure rate and the number of components.

In semiconductor memories there are two types of failure mechanisms. The first is a hard error in which the device structure fails. The second, a soft error, is a random, non-recurring error caused by alpha particles.

As memories become denser, their storage area becomes smaller. As a result they can become more sensitive to soft errors.

6.18. Обсудите следующие темы:

1. Core memory. 2. Semiconductor memory. 3. Charge-coupled devices. 4. Magnetic bubble devices. 5. Electron beam-addressed memories.

МАТЕРИАЛЫ ДЛЯ САМОСТОЯТЕЛЬНОЙ ВНЕАУДИТОРНОЙ РАБОТЫ (ПОСЛЕ ВТОРОГО ЗАНЯТИЯ)

Учитесь читать и переводить.

Текст 6.8. Просмотрите текст. Озаглавьте его. Аргументируйте свой выбор заголовка. Прочитайте текст еще раз. Подготовьте сообщение о разных типах памяти.

The electron beam is an addressing pointer of high definition and energy density that can easily be deflected. In storage tubes of the 1940's there were severe limitations to such addressing because of the use of surface charge storage and inadequacies in focusing and deflecting the beam. Two recent innovations, storage within a semiconductor and compounded deflection, may bring us closer to realizing the inherent potential of beam addressing.

The addressing is in two parts. First, the beam is deflected by a short conical structure of low aberration and strikes normally one of the appertures of a matrix of lenslets.

The matrix is made up of two metal plates that have an array of holes (an 18 by 18 array on 1.5-mm centres) and are maintained at different potentials. Second, the beam is deflected by bars running along rows and columns between the holes of the matrix. No matter which lenslet is reached, the reduced beam will be subjected to the second deflection. In this compounded deflection the accuracy and stability at each step need only be a small fraction of what would be required with a single step.

Текст 6.9. Прочитайте текст и сделайте обобщение информации об особенностях кэш-памяти.

Cache Memory

A cache memory is a small, high-speed system memory that fits between the CPU and the main memory. It accesses copies of the most frequently used main-memory data. When the CPU tries to read data from the main memory, the cache memory will respond first if it has a copy of the requested data. If it doesn't, a normal main-memory cycle will occur.

Cache memories are effective because computer programs spend most of their memory cycles accessing a very small part of the memory.

A cache memory cell has three components: an address memory cell, an address comparator and a data memory cell. The data and address memory cells together record one word of cached data and its corresponding address in main memory. The address

comparator checks the address cell contents against the address on the memory address bus. If they match, the contents of the data are placed on the data bus.

An ideal cache memory would have many cache memory cells, each holding a copy of the most frequently used main-memory data. This type of cache memory is called fully associative because access to the data in each memory cell in through the data's associated, stored address.

Not all locations in the memory address space should be cached. Hardware I/O address shouldn't be cached because bits in an I/O register can and must change at any time, and a cache copy of an earlier I/O state may not be valid.

6.19. Изучите таблицу "Memory Technology". Дополните ее известными вам данными о типах памяти.

Memory Technology

Type	Predominant Technology	Cycle or access time
Registers and discrete bit storage	Monolithic integrated circuits	50 to 500 nano-seconds
High speed control and scratch-pads	Planar thin films	100 to 500 nano-seconds
High speed internal main memories	Magnetic core	0.3 to 5 micro-seconds
Random-access auxiliary storage	Magnetic core	2 to 10 micro-seconds
On-line auxil-	Electromechanical	15 to 150 milli-

	iary storage disk files	seconds
serial	Off-line auxil- Magnetic tape iary storage access	Serial
	...	

6.20. Подготовьте сообщение для обсуждения теми 'The State-of-art and Future Developments of Memory nologies".

ИТОГОВЫЕ ЗАНЯТИЯ

I. а) Составьте схему, показывающую основные направления применения микроэлектроники в обществе.

б) Используя вашу схему, подготовьте сообщение "Application Fields of Microelectronics: Material Production, Non-productive Sphere, Personal Uses".

II. Проведите групповую научно-техническую конференцию по проблемам микроэлектроники и перспективам ее развития.

Темы, предлагаемые для обсуждения:

1. In the world of microelectronics.
2. From the history of microelectronics.
3. The top priorities in the field of microelectronics for the next decade.
4. Prospects of the IC's design.
5. Microprocessors: the state-of-art.
6. The main problems the designer of a microelectronic device is faced with nowadays.
7. From the history of Computer Science.
8. Fantastic possibilities of computer and information systems.
9. Progress in the computer revolution.
10. Man-machine systems.
11. Automatic control systems.
12. Systems for computer translation.
13. The advent of minicomputers brings a higher level of information culture.

СПИСОК СОКРАЩЕНИЙ, ВСТРЕЧАЮЩИХСЯ В ПОСОБИИ

ALU (arithmetic and logic unit) — арифметически-логическое устройство АЛУ.

CAD/CAM (computer-aided design/computer-aided manufacturing) — автоматизированное проектирование и производство. CCD (charge-coupled device) - прибор с зарядовой связью,

пзс.

CMOS (complementary metal-oxide-semiconductor) — комплементарная МОП структура, КМОП структура. CPU (central processing unit) — центральный процессор, центральное процессорное устройство, ЦПУ. CRT (cathode ray tube) — электронно-лучевая трубка, ЭЛТ. CVD (chemical vapour deposition) — химическое осаждение из паровой фазы.

EAROM (electrically-alterable read-only memory)-ПЗУ с электрическим программированием. EPI, epi (epitaxial) — эпитаксиальный слой. EPROM (erasable-programmable ROM) — программируемое стираемое ПЗУ.

EROM (erasable read-only memory) — стираемое ПЗУ. FET, Fet (field-effect transistor) — полевой транзистор, ПТ. HBT (heterostructure bipolar transistor) — биполярный транзистор на гетероструктуре.

HIC (hybrid integrated circuit) — гибридная интегральная схема, ГИС.

IC (integrated circuit) — интегральная схема, ИС. IIL (integrated injection logic) — интегральные, инжекционные логические схемы, $И^2Л$.

IMPAAT (impact avalanche and transit time (diode) — лавиннопролетный диод, ЛПД.

JFET (junction field effect transistor) — полевой транзистор с p n переходом.

K (kilobyte) — килобайт.

LSI (large scale integration) — высокая степень интеграции,

БИС.

LPCVD (low-pressure chemical vapour deposition) — химическое осаждение из паровой фазы при низком давлении. MC (microcircuit) — микросхема ИС.

MESFET (metal-Shottky field-effect transistor) — полевой транзистор с затвором Шотки.

MOS (metal-oxide-semiconductor) — структура металл-оксид-полупроводник, МОП-структура.

MOSFET (metal-oxide-semiconductor field-effect transistor) — МОП-транзистор.

MP (monolithic processor) — однокристальный микропроцессор.

MSI (medium-scale integration) - ИС со средней степенью интеграции, СИС.

MP (microprocessor) — микропроцессор. MTBF (mean-time between failures) — среднее время между отказами.

NMOS (n-channel metal-oxide-semiconductor) — n-МОП-струк-тура.

O.D. (overall-dimensions) — габаритные размеры. PC (personal computer) — персональный компьютер, ПК. PCB (printed circuit board) — печатная плата. PLA (programmed logic array) — программируемая логическая матрица, ПЛМ.

PMOS (p-channel metal-oxide-semiconductor) — p-МОП-струк-тура.

PROM (programmable read-only memory) — ППЗУ. RAM (random-access memory) — ЗУ с произвольной выборкой, ЗУПВ.

RC (resistance-capacitance) — сопротивление-емкость. RF (radio-frequency) — радиочастота. ROM (read-only memory) — постоянные ЗУ, ПЗУ. SAM (serial access memory) — ЗУ с последовательной выборкой.

SSI (small-scale integration) — малая степень интеграции, малая ИС.

TTL (transistor-transistor logic) - транзисторно-транзисторная логика, ТТЛ.

TWT (travelling wave tube) — лампа бегущей волны, ЛБВ. UTTV (ultrahigh vacuum) — сверхвысокий вакуум. ULSI (ultra-large scale integration) — ИС со степенью интеграции выше сверхвысокой.

VHSIC (very high-speed integrated circuit) - сверхскоростная (сверхбыстродействующая) ИС, ССИС. VLSI (very large scale integration) - сверхбольшая ИС, СБИС. ppm (parts per million) — частиц на миллион.

АЛФАВИТНЫЙ СПИСОК СЛОВ, ВЫДЕЛЕННЫХ В ОСНОВНЫХ ТЕКСТАХ

(после слова даны номер урока и порядковый номер слова в поурочном словаре)

Accept n 2,36 access и 5,6 accessible a 1,61 accomplish v 4,12 acid n 3,41 acquire v 5,30 add v 2,33 address v 6,21 adequate a 5,40 adhere v 2,45 adjacent a 3,20 advance и 3,55 advent n 1,38 affect v 2,32 aid n 3,66 aim n 6,41 alloy n 3,44 alternately adv 2,25 amount n 4,14 amplifier n 2,24 anticipate v 5,26 apparent a 4,63 appreciable a 2,12 approach v 6,38 appropriate a 5,34 array n 1,53 artificial a 4,48 assemble v 1,32 assign v 6,22 attainable a 1,22 attributable a 2,40 available a 2,5 average a 4,19

Background n 4,61 backup n 4,65 band n 2,48 behaviour n 4,62 below adv 3,10 benefit n11,20 bottom n 3,9 boundary n 1,54 branching n 6,26 bubble n 3,27 bulk n 3,45 bus n 5,15 byte n 6,19

Call for v 4,13 call n 6,9 capability n 1,5 capacity n 6,4 card n 4,27 carry out n 1,9 cell n 6,15 challenge n 6,27 character n 6,20 check v 4,52 chip n 1,47 circumstance n 3,24 coating n 2,52 column n 6,13 commerce n 4,16 commercial a 2,39 common a 2,19 compatible a 6,30 compete v 1,7 complicated a 4,4 concept n 1,37 concern n 1,27 conjunction n 6,49 constitute v 4,68 consume v 4,46 contemporary a 4,8 contrast n 6,16 contribution n 2,20 convenient a 4,70 conventional a 2,63 conversion n 5,41 core n 6,18 correspond v 5,19 count v 4,1 coupling n 1,21 crucial c 5,39 current n 4,55 cycle n 6,8

Deficiency n 3,23 define v 1,52 delay n 2,7 delineate v 3,34 denote y 3,43 deposition n 3,57 design и 2,15 despite prp 4,11 destined a 4,54 determine v 2,9 detrimental c 2,54 devise v 5,25 die (dice) n 3,63 differentiate v 5,17 diffuse v 3,16 dimension n 1,18 dissipation n 5,9 dissolve v 3,39 distinction n 6,11 distinguish v 4,41 distribute v 4,6 domain n 6,42 dopant n 2,47 dozen n 5,3drawback n 6,24 due a 3,68 durable a 2,44

Effort n 1,1 eliminate v 5,10 emerge v 1,65 emphasize v 6,25 enable v 3,59 enhance v 2,6 entire a 4,29 environment n 4,10 error n 4,49 establish v 3,48 etch v 3,32 event n 1,14 exact a 5,24 exceedingly adv 1,8 excite v 5,18 execute v 4,38 exhibit v 2,2 expend v 3,6 explicate v 2,62 expose v 3,31 extend v 1,67

Facility n 4,43 fail v 4,45 fault n 5,36 feasible a 5,22 feature n 2,1 feed v 4,26 feedback n 6,23 ffll v3,7 fit v 1,57 flexible a 4,37 flip-flop n 4,34 former c 3,15 furnish v 6,1

Gain v 2,38 gap n 2,49 gate v 1,51 generate v 4,73 goal n 1,11 grain n 2,27

Handling n 1,26 harmful a 3,49 hence adv 3,4 hinder v 4,44

Image n 4,60 immense a 2,29 impact n 5,12 impermeable a 2,51 impetus n 1,35 implement v 4,39 imply v 5,16 improve v 3,14 incorporate v 4,40 indeed adv 4,9 inevitable a 5,11 inferior a 5,20 inherently adv 2,60 initial a 4,2 innovation n 3,54 insert v 3,22 intelligence n 5,33 intend v 4,58 interface n 3,46 interior a 3,19 intermediate a 3,5 interpret v 4,32 intersect v 6,33 intricate a 3,64 intrinsic a 2,17 involve v 1,44 issue n 4,30

Junction n 1,45 Key n 1,41

Label v 4,36 lattice n 3,1 layer n 2,53 level n 2,10 line n 1,63 link v 4,42 load n 4,71 long a 5,28

Main a 4,20 mainframe a 4,20 maintain v 2,55 manifold adv 1,24 manner n 6,12 manufacture v 1,31 mark v 1,55 market n 6,31 maskn 2,46 medium n 3,5 memory n 6,3 merely adv 3,25 merge v 4,64 message n 4,50 mode n 1,59 monitor v 4,18 mount v 4,33 multiply v 3,35

Net n 2,11 nevertheless adv 3,26

Obstacle n 4,72 occur v 2,22 offshoot n 5,1 once adv 1,30 opportunity n 2,61 option n 6,36 original a 4,3 outline n 3,60 outmoded a 4,57 overall a 1,28 overlap v 6,6 overlayer n 2,53

Pack v 1,58 particular a 1,23 pattern n 1,43 perfection n 2,35 performance n 1,3 peripheral a 5,7 permit v 2,50 planar a 1,62 point n 1,19 poor a 3,11 port a 4,24 port n 4,24 posev 3,13 precipitate v 3,47 precise a 3,37 predict v 1,4 prevent v 3,40 print n 4,35 prior to prp 1,6 procedure n 3,38 proceed v 3,38 processibility n 2,4 protect v 3,30 provide v 5,38 pull v 3,56 punch v 4,27 purity n 2,34

Random a 5,5 range n 2,56/5,21 rate n 1,16 read v 4,31 realize v 1,12 reason n 2,30 recall v 6,5 recognize v 2,28 record v 4,5 rectangular a 6,32 rectification n 2,21 reel v 6,17 refer v 1,46 refinement n 2,59 regard v 4,23 related c 2,13 reliability n 1,2 remote a 4,74 remove v 3,50 resident a 5,32 residual a 4,53 resolution n 1,66 respond v 1,15 rest n 5,29 restrict v 4,47 retrieve v 4,28 row n 6,14

Scale n 1,13 screen n 4,59 security n 5,23 sense n 1,60 sequence n 3,33 sequential a 4,15 set n 5,8 share v 5,40 shifting n 1,56 shortcoming n 1,29 shrink v 1,17 shutdown n 5,35 significant a 2,8 signify v 6,7 similar a 1,39 simulate v 3,67 simultaneous a 6,35 site n 3,18 skffl n 4,67 slice n 3,52 so far co 6,10 soften v 2,41 solid n 1,10 sophisticated a 3,53 species n 3,61 specification n 2,57 spectacular a 4,21 spread v 5,41 sputter v 3,58 stage n 3,36 state n 1,50 step n 3,29 store v 4,22 stringy 6,28 stringent a 2,58 substance n 3,2 substitute v 3,17 substrate n 1,40 subtle a 2,14 succeed v 6,29 sufficient a 2,64 suitable a 2,18 superficial a 4,56 supply v 5,13 switch v 1,25

Tailor v 2,16 target n 6,34 technique n 1,42 technology n 1,42 temporary a 5,31 term n 3,42 thus adv 3,12 tightly adv 3,3 time n 5,14 tolerable a 1,48 tool n 3,51 top n 3,8 trace v 2,26 tradeoff n 4,66 transactions n 4,17 transfer v 3,28 trap n 2,31 trend n 4,51 troubleshooting n 537 turn n 2,23

Ultimately adv 1,36 upgrade v 5,4 upsurge n 5,2

Vacancy n 3,21 vapour n 2,43 vast a 6,41 vehicle n 1,34 versatile a 4,69 view n 4,7 volatile a 3,62 volume n 6,37 vulnerability n 2,3

Wafer n 2,42 waveguide n 1,64 whereby adv 4,25 wiring n 1,33 witness v 2,37 word n 5,27 workload 4,71 worthwhile a 6,2

Yield n 1,49

Учебное издание

Зайцева Людмила Павловна, Бух Майя Анатольевна

МИКРОЭЛЕКТРОНИКА: НАСТОЯЩЕЕ И БУДУЩЕЕ

Пособие по обучению чтению на английском языке

Зав. редакцией И.Э. Волкова. Редактор Л.Н. Белая. Художник Ю.Д. Федич кин. Художественный редактор В.И. Пономаренко. Технический редактор

А.А. Акимова. Старший корректор З.Ф. Юрескул.

Оператор В.А, Челышева

И Б № 7943

Изд. № А-115. Сдано в набор 31.01.89. Подп. в печать 29.09.89. Формат $84x108^{1}/_{32}$ Бумага кн-журн.. Гарнитура Тайме. Печать высокая. Объем 8,40 усл.печ.ч. 8,61 усл.кр.-отт. 10,07 уч.-изд.л. Тираж 50000 экз. Заказ № 689.

Цена 35 коп.

Издательство «Высшая школа», 101430, Москва, ГСП-4, Неглинная ул., д. 29/14

Набрано на участке персональных компьютеров издательства «Высшая школа".

Отпечатано в Ярославском полиграфкомбинате Госкомпечати СССР. 150014, Ярославль, ул. Свободы, 97.