МИНОБРНАУКИ РОССИИ
Федеральное государственное бюджетное образовательное учреждение
высшего образования
«МИРЭА – Российский технологический университет»

Общий факультет (Фрязино)

УТВЕРЖДАЮ

Директор филиала РТУ МИРЭА в г. Фрязино

_______________ Макарова Л.А.

«___» ___________ 2021 г.

Рабочая программа дисциплины (модуля)

Технический английский язык

Читающее подразделение	**кафедра общенаучных дисциплин**
Направление	**11.03.03 Конструирование и технология электронных средств**
Направленность	**Проектирование и технология радиоэлектронных средств**
Квалификация	**бакалавр**
Форма обучения	**очная**
Общая трудоемкость	**6 з.е.**

Распределение часов дисциплины и форм промежуточной аттестации по семестрам

Семестр	Зачётные единицы	Распределение часов							Формы промежуточной аттестации
		Всего	Лекции	Лабораторные	Практические	Самостоятельная работа	Контактная работа в период практики и (или) аттестации	Контроль	
5	3	108	0	0	32	58	0,25	17,75	Зачет
6	3	108	0	0	32	58	0,25	17,75	Зачет

Москва 2021

Программу составил(и):

старший преподаватель, Татаркина Светлана Михайловна _________________

Рабочая программа дисциплины
Технический английский язык

разработана в соответствии с ФГОС ВО:
Федеральный государственный образовательный стандарт высшего образования - бакалавриат по направлению подготовки 11.03.03 Конструирование и технология электронных средств (приказ Минобрнауки России от 19.09.2017 г. № 928)

составлена на основании учебного плана:
направление: 11.03.03 Конструирование и технология электронных средств
направленность: «Проектирование и технология радиоэлектронных средств»

Рабочая программа одобрена на заседании кафедры
кафедра общенаучных дисциплин

Протокол от 30.08.2021 № 1

Зав. кафедрой Щучкин Григорий Григорьевич ___________________

Визирование РПД для исполнения в очередном учебном году

Рабочая программа пересмотрена, обсуждена и одобрена для исполнения в 2022-2023 учебном году на заседании кафедры
кафедра общенаучных дисциплин

Протокол от __ __________ 2022 г. № __

Зав. кафедрой ____________________ ____________________
Подпись Расшифровка подписи

Визирование РПД для исполнения в очередном учебном году

Рабочая программа пересмотрена, обсуждена и одобрена для исполнения в 2023-2024 учебном году на заседании кафедры
кафедра общенаучных дисциплин

Протокол от __ __________ 2023 г. № __

Зав. кафедрой ____________________ ____________________
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кафедра общенаучных дисциплин

Протокол от __ __________ 2024 г. № __

Зав. кафедрой ____________________ ____________________
Подпись Расшифровка подписи

Визирование РПД для исполнения в очередном учебном году

Рабочая программа пересмотрена, обсуждена и одобрена для исполнения в 2025-2026 учебном году на заседании кафедры
кафедра общенаучных дисциплин

Протокол от __ __________ 2025 г. № __

Зав. кафедрой ____________________ ____________________
Подпись Расшифровка подписи

1. ЦЕЛИ ОСВОЕНИЯ ДИСЦИПЛИНЫ (МОДУЛЯ)

Дисциплина «Технический английский язык» имеет своей целью способствовать формированию у обучающихся компетенций. предусмотренных данной рабочей программой в соответствии с требованиями ФГОС ВО по направлению подготовки 11.03.03 Конструирование и технология электронных средств с учетом специфики направленности подготовки – «Проектирование и технология радиоэлектронных средств».

2. МЕСТО ДИСЦИПЛИНЫ (МОДУЛЯ) В СТРУКТУРЕ ОБРАЗОВАТЕЛЬНОЙ ПРОГРАММЫ

Направление:	11.03.03 Конструирование и технология электронных средств
Направленность:	Проектирование и технология радиоэлектронных средств
Блок:	Дисциплины (модули)
Часть:	Часть, формируемая участниками образовательных отношений
Общая трудоемкость:	6 з.е. (216 акад. час.).

3. КОМПЕТЕНЦИИ ОБУЧАЮЩЕГОСЯ, ФОРМИРУЕМЫЕ В РЕЗУЛЬТАТЕ ОСВОЕНИЯ ДИСЦИПЛИНЫ (МОДУЛЯ)

В результате освоения дисциплины обучающийся должен овладеть компетенциями:

УК-4 - Способен осуществлять деловую коммуникацию в устной и письменной формах на государственном языке Российской Федерации и иностранном(ых) языке(ах)

ПК-2 - Способен производить и внедрять радиоэлектронные средства

ПК-1 - Способен разрабатывать и проектировать радиоэлектронные средства

ПК-3 - Способен проводить измерения и испытания радиоэлектронных средств

ПЛАНИРУЕМЫЕ РЕЗУЛЬТАТЫ ОБУЧЕНИЯ ПО ДИСЦИПЛИНЕ (МОДУЛЮ), ХАРАКТЕРИЗУЮЩИЕ ФОРМИРОВАНИЯ КОМПЕТЕНЦИЙ

УК-4 : Способен осуществлять деловую коммуникацию в устной и письменной формах на государственном языке Российской Федерации и иностранном(ых) языке(ах)

УК-4.1 : Осваивает принципы построения устного и письменного высказывания на русском и иностранном языках, правила и закономерности деловой устной и письменной коммуникации.

Знать:

- Грамматическую систему иностранного языка для осуществления коммуникации в рамках профессиональной деятельности;
- Лексический минимум для эффективного осуществления деловой коммуникации в рамках профессиональной деятельности;
- Особенности стилистики официальных писем для осуществления коммуникации в рамках профессиональной деятельности.

Уметь:

- Логически верно организовывать устную и письменную речь на иностранном языке;

Владеть:

- Навыками письменной речи, приемами деловой переписки

УК-4.2 : Применяет на практике деловую коммуникацию в устной и письменной формах, методы и навыки делового общения на русском и иностранном языках.

Знать:

- Основы устной и письменной коммуникации на иностранном языке при написании аннотаций статей и реферировании статей научно-технического характера, в ситуациях делового общения;

Уметь:

- Выражать свои мысли на иностранном языке в письменной и устной форме, в ситуациях делового общения;

Владеть:

- Навыками коммуникации на иностранном языке с использованием разных по сложности грамматических конструкций и изученного лексического минимума;

УК-4.3 : Использует навыки чтения и перевода текстов на иностранном языке в профессиональном общении, навыки деловых коммуникаций в устной и письменной формах на русском и иностранном языках, методику составления суждения в межличностном деловом общении на русском и иностранном языках.

Знать:

- Грамматические, стилистические и лексические особенности научно-технических текстов на иностранном языке;
- Основные иноязычные термины, определения и понятия, связанные с будущей профессиональной деятельностью;
- Правила оформления, структуру и стиль научно-технических иноязычных статей и аннотаций

Уметь:

- Проводить переводы текстов технического характера в рамках профессиональной деятельности;
- Использовать иностранный язык в профессиональной деятельности;
- Понимать основную идею, заложенную в научной статье, анализировать ее структуру и содержание;

Владеть:

- Навыками извлечения необходимой информации из оригинальных текстов на иностранном языке по профессиональной тематике;
- Переводческими приемами с иностранного языка на родной научно-технических текстов, связанных с будущей профессиональной деятельностью;
- Навыками устной и письменной коммуникации для решения задач профессиональной деятельности;

ПК-2 : Способен производить и внедрять радиоэлектронные средства

ПК-2.1 : Разрабатывает технологический маршрут на изготовления радиоэлектронного устройства

Знать:

- Технический английский язык в области микро- и наноэлектроники

ПК-2.2 : Проводит подготовку производственных помещений и технологического оборудования для реализации новых технологических процессов изготовленгия радиоэлектронных средств.

Знать:

- Технический английский язык в области микро- и наноэлектроники
- Принцип работы и устройство контрольно-измерительного оборудования, применяемого для контроля параметров изделий "система в корпусе"
- Техническая документация на контрольно-измерительное оборудование, применяемое для контроля параметров изделий "система в корпусе"
- Правила настройки и регулировки контрольно-измерительного оборудования для контроля параметров изделий "система в корпусе"
- Методики контроля физико-химических параметров материалов, применяемых для изготовления изделий "система в корпусе"
- Методики измерения, расчета и контроля режимов работы контрольно-измерительного оборудования, применяемого для контроля параметров изделий "система в корпусе"

- Требования законодательства Российской Федерации, технических регламентов, сводов правил, стандартов в области испытаний изделий "система в корпусе"

Уметь:

- Работать на контрольно-измерительном оборудовании, применяемом для контроля параметров изделий "система в корпусе"
- Измерять параметры изделий "система в корпусе"
- Оценивать качество сборки пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"
- Формировать базы данных измерений параметров изделий "система в корпусе"
- Оформлять техническую документацию по контролю параметров пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"
- Оформлять отчетную документацию о выполняемых работах
- Планировать ресурс рабочего времени контроля параметров изделий "система в корпусе" в рамках установленного задания, графика, плана

Владеть:

- Составление контрольной карты качества сборки пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"
- Измерение параметров изделий "система в корпусе" в соответствии с разработанными методиками в процессе сборки пассивной части схемы
- Формирование базы данных измерений параметров изделий "система в корпусе" в процессе сборки пассивной части схемы
- Статистическая обработка измеренных параметров изделий "система в корпусе" в процессе сборки пассивной части схемы
- Составление учетной и отчетной документации проведения контроля параметров и оценки качества сборки пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"

ПК-3 : Способен проводить измерения и испытания радиоэлектронных средств

ПК-3.1 : Проводит испытания и измерения радиоэлектронных средств

Знать:

- Технический английский язык в области микро- и наноэлектроники

Уметь:

- Производить настройку и калибровку измерительного оборудования для проведения измерений изделий "система в корпусе"

ПК-3.2 : Составляет и утверждает программы испытаний и обработки результатов измерений и испытаний радиоэлектронных средств на основе требований технического задания

Знать:

- Технический английский язык в области микро- и наноэлектроники

ПК-1 : Способен разрабатывать и проектировать радиоэлектронные средства

ПК-1.2 : Разрабатывает структурные и функциональные схемы радиолектронных средств, принципиальные схемы устройств с использованием средств компьютерного проектирования, проведением проектных расчетов и технико-экономическим обоснованием принимаемых решений

Знать:

- Технический английский язык
- Профессиональная терминология на английском языке

Уметь:

- Выполнять поиск данных о шкафах с низкой плотностью компоновки элементов, блоках с высокой плотностью компоновки элементов и пассивных объединительных печатных платах в электронных справочных системах и библиотеках

Владеть:

- Сбор, изучение и анализ информации для формирования исходных данных для конструирования шкафов с низкой плотностью компоновки элементов, блоков с высокой плотностью компоновки элементов и пассивных объединительных печатных плат
- Настройка прикладных программ, используемых для конструирования шкафов с низкой плотностью компоновки элементов, блоков с высокой плотностью компоновки элементов и пассивных объединительных печатных плат

ПК-1.3 : Разрабатывает технические описания на отдельные блоки и радиоэлектронное устройство в целом

Знать:

- Технический английский язык в области микро- и наноэлектроники
- Профессиональная терминология на английском языке
- Технический английский язык

В РЕЗУЛЬТАТЕ ОСВОЕНИЯ ДИСЦИПЛИНЫ (МОДУЛЯ) ОБУЧАЮЩИЙСЯ ДОЛЖЕН

Знать:

- Технический английский язык
- Технический английский язык в области микро- и наноэлектроники
- Технический английский язык в области микро- и наноэлектроники
- Профессиональная терминология на английском языке
- Технический английский язык
- Профессиональная терминология на английском языке
- Технический английский язык в области микро- и наноэлектроники
- Принцип работы и устройство контрольно-измерительного оборудования, применяемого для контроля параметров изделий "система в корпусе"
- Требования законодательства Российской Федерации, технических регламентов, сводов правил, стандартов в области испытаний изделий "система в корпусе"
- Технический английский язык в области микро- и наноэлектроники
- Технический английский язык в области микро- и наноэлектроники
- Методики измерения, расчета и контроля режимов работы контрольно-измерительного оборудования, применяемого для контроля параметров изделий "система в корпусе"
- Техническая документация на контрольно-измерительное оборудование, применяемое для контроля параметров изделий "система в корпусе"
- Правила настройки и регулировки контрольно-измерительного оборудования для контроля параметров изделий "система в корпусе"
- Методики контроля физико-химических параметров материалов, применяемых для изготовления изделий "система в корпусе"
- Грамматические, стилистические и лексические особенности научно-технических текстов на иностранном языке;
- Особенности стилистики официальных писем для осуществления коммуникации в рамках профессиональной деятельности.
- Правила оформления, структуру и стиль научно-технических иноязычных статей и аннотаций
- Основные иноязычные термины, определения и понятия, связанные с будущей профессиональной деятельностью;
- Лексический минимум для эффективного осуществления деловой коммуникации в рамках профессиональной деятельности;
- Грамматическую систему иностранного языка для осуществления коммуникации в рамках профессиональной деятельности;

- Основы устной и письменной коммуникации на иностранном языке при написании аннотаций статей и реферировании статей научно-технического характера, в ситуациях делового общения;

Уметь:

- Работать на контрольно-измерительном оборудовании, применяемом для контроля параметров изделий "система в корпусе"
- Логически верно организовывать устную и письменную речь на иностранном языке;
- Оформлять отчетную документацию о выполняемых работах
- Планировать ресурс рабочего времени контроля параметров изделий "система в корпусе" в рамках установленного задания, графика, плана
- Производить настройку и калибровку измерительного оборудования для проведения измерений изделий "система в корпусе"
- Оформлять техническую документацию по контролю параметров пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"
- Измерять параметры изделий "система в корпусе"
- Оценивать качество сборки пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"
- Формировать базы данных измерений параметров изделий "система в корпусе"
- Проводить переводы текстов технического характера в рамках профессиональной деятельности;
- Использовать иностранный язык в профессиональной деятельности;
- Выполнять поиск данных о шкафах с низкой плотностью компоновки элементов, блоках с высокой плотностью компоновки элементов и пассивных объединительных печатных платах в электронных справочных системах и библиотеках
- Выражать свои мысли на иностранном языке в письменной и устной форме, в ситуациях делового общения;
- Понимать основную идею, заложенную в научной статье, анализировать ее структуру и содержание;

Владеть:

- Формирование базы данных измерений параметров изделий "система в корпусе" в процессе сборки пассивной части схемы
- Составление учетной и отчетной документации проведения контроля параметров и оценки качества сборки пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"
- Статистическая обработка измеренных параметров изделий "система в корпусе" в процессе сборки пассивной части схемы
- Переводческими приемами с иностранного языка на родной научно-технических текстов, связанных с будущей профессиональной деятельностью;
- Навыками устной и письменной коммуникации для решения задач профессиональной деятельности;
- Навыками извлечения необходимой информации из оригинальных текстов на иностранном языке по профессиональной тематике;
- Сбор, изучение и анализ информации для формирования исходных данных для конструирования шкафов с низкой плотностью компоновки элементов, блоков с высокой плотностью компоновки элементов и пассивных объединительных печатных плат
- Настройка прикладных программ, используемых для конструирования шкафов с низкой плотностью компоновки элементов, блоков с высокой плотностью компоновки элементов и пассивных объединительных печатных плат
- Навыками коммуникации на иностранном языке с использованием разных по сложности грамматических конструкций и изученного лексического минимума;
- Измерение параметров изделий "система в корпусе" в соответствии с разработанными методиками в процессе сборки пассивной части схемы

- Составление контрольной карты качества сборки пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"
- Навыками письменной речи, приемами деловой переписки

4. СТРУКТУРА И СОДЕРЖАНИЕ ДИСЦИПЛИНЫ (МОДУЛЯ)

При проведении учебных занятий организация обеспечивает развитие у обучающихся навыков командной работы, межличностной коммуникации, принятия решений и лидерских качеств.

Код занятия	Наименование разделов и тем /вид занятия/	Сем.	Часов	Компетенции
	1. I. Лексические аспекты перевода			
1.1	**Выполнение практических заданий (Пр).** Особенности перевода научно-технической литературы. Общие принципы перевода слов. Перевод словосочетаний на русский язык, многозначных слов при помощи узкого контекста.	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.2	**Выполнение практических заданий (Пр).** Изменение значения слов в зависимости от контекста. Перевод безэквивалентной лексики. Приближенный перевод. Развитие электроники	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.3	**Выполнение домашнего задания (Ср).** Перевод аутентичного текста «Принцип работы и устройство контрольно-измерительного оборудования, применяемого для контроля параметров изделий "система в корпусе"»	5	3,625	УК-4.1, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
1.4	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	5	3,625	УК-4.1, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
1.5	**Выполнение практических заданий (Пр).** Перевод терминов. Многокомпонентные термины и их перевод. Перевод с использованием лексического эквивалента. Интернациональные слова.	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.6	**Выполнение практических заданий (Пр).** Практикум по переводу интернациональных и псевдоинтернациональных слов на русский язык.Микроэлектроника и микроминиатюризация	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.7	**Выполнение домашнего задания (Ср).** Перевод текста без словаря с определением интернациональных слов. Устный перевод научно-технического текста, содержащего интернациональную лексику «Методики контроля физико-химических параметров материалов, применяемых для изготовления изделий "система в корпусе"»	5	3,625	УК-4.1, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
1.8	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	5	3,625	УК-4.1, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1

1.9	**Выполнение практических заданий (Пр).** Неологизмы.Заимствования из других языков. Расширение или переосмысление значения. Практикум по переводу предложений научно-технического характера, содержащих слова-неологизмы.	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.10	**Выполнение практических заданий (Пр).** Подготовку производственных помещений и технологического оборудования для реализации новых технологических процессов изготовления радиоэлектронных средств. Практикум по научно-техническому переводу	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.11	**Выполнение домашнего задания (Ср).** Перевод аутентичного текста «Методики измерения, расчета и контроля режимов работы контрольно-измерительного оборудования, применяемого для контроля параметров изделий "система в корпусе"»	5	3,625	УК-4.1, УК-4.2, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
1.12	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	5	3,625	УК-4.1, УК-4.2, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
1.13	**Выполнение практических заданий (Пр).** Сокращения и способы их перевода. Сокращения-заимствования. Аббревиатура. Практикум по переводу предложений, содержащих сокращения. Перевод сокращений, характерных для научно-технической литературы.	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.14	**Выполнение практических заданий (Пр).** Список сокращений, часто встречающихся в научно-технической литературе Великобритании и США. Практикум по переводу атрибутивных словосочетаний на русский язык	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.15	**Выполнение домашнего задания (Ср).** Полный письменный перевод аутентичного текста, содержащего сокращения.	5	3,625	УК-4.1, УК-4.2, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
1.16	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	5	3,625	УК-4.1, УК-4.2, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
1.17	**Выполнение практических заданий (Пр).** Перевод словосочетаний. Трансформации при переводе. Основные способы перевода английских атрибутивных словосочетаний.Практикум по переводу атрибутивных словосочетаний на русский язык и предложений с использованием трансформаций, необходимых при переводе	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2

1.18	**Выполнение практических заданий (Пр).** Радиоэлектронные средства. Измерения и испытания радиоэлектронных средств. Практикум по переводу атрибутивных словосочетаний на русский язык и предложений с использованием трансформаций, необходимых при переводе	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
1.19	**Выполнение домашнего задания (Ср).** Полный письменный перевод аутентичного текста с атрибутивными словосочетаниями. Перевод энциклопедической статьи технического характера.	5	3,625	УК-4.1, УК-4.2, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
1.20	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	5	3,625	УК-4.1, УК-4.2, УК-4.3, ПК-2.2, ПК-1.2, ПК-3.1
2. II. Грамматические аспекты перевода				
2.1	**Выполнение практических заданий (Пр).** Грамматические аспекты перевода. Перевод артикля, глаголов в страдательном залоге, эмфатических конструкций. Грамматический практикум на употребление артикля. Перевод предложений, содержащих глагол-сказуемое в страдательном залоге.	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
2.2	**Выполнение практических заданий (Пр).** Программа испытаний и обработка результатов измерений и испытаний радиоэлектронных средств на основе требований технического задания. Практикум по переводу предложений, содержащих эмфатические конструкции и инверсии	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
2.3	**Выполнение домашнего задания (Ср).** Полный письменный перевод аутентичных текстов, определение способов передачи при переводе глаголов в страдательном залоге, выявление эмфатических конструкций.	5	3,625	УК-4.1, УК-4.2
2.4	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	5	3,625	УК-4.1, УК-4.2
2.5	**Выполнение практических заданий (Пр).** Перевод инфинитива и инфинитивных оборотов. Оборот «именительный падеж с инфинитивом» (Complex Subject). Инфинитивный оборот «сложное дополнение» (Complex Object). Перевод причастия и причастных оборотов. Перевод герундия и герундиальных оборотов.	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
2.6	**Выполнение практических заданий (Пр).** Грамматический практикум на разграничение перфектных и неперфектных форм инфинитива в английском языке. Перевод предложений, содержащих инфинитив, причастие и герундий, причастные и герундиальные обороты	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2

2.7	**Выполнение домашнего задания (Ср).** Перевод аутентичных текстов, содержащих инфинитив и инфинитивные конструкции, причастие и причастные обороты, герундий и герундиальные обороты.	5	3,625	УК-4.1, УК-4.2
2.8	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	5	3,625	УК-4.1, УК-4.2
2.9	**Выполнение практических заданий (Пр).** Перевод условных предложений. Сослагательное наклонение. Перевод модальных глаголов. Модальные глаголы с перфектными инфинитивами. Грамматический практикум по употреблению сослагательного наклонения, определение типов условных предложений, по употреблению модальных глаголов.	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
2.10	**Выполнение практических заданий (Пр).** Настройка прикладных программ, используемых для конструирования шкафов с низкой плотностью компоновки элементов, блоков с высокой плотностью компоновки элементов и пассивных объединительных печатных плат. Грамматический практикум на употребление сослагательного наклонения	5	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
2.11	**Выполнение домашнего задания (Ср).** Перевод аутентичного текста с выявлением условных предложений, определением их типов, а также текста, содержащего модальные глаголы с перфектными инфинитивами.	5	3,625	УК-4.1, УК-4.2
2.12	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	5	3,625	УК-4.1, УК-4.2
3. Промежуточная аттестация (зачёт)				
3.1	**Подготовка к сдаче промежуточной аттестации (Зачёт).**	5	17,75	УК-4.1, УК-4.2, УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
3.2	**Контактная работа с преподавателем в период промежуточной аттестации (КрПА).**	5	0,25	УК-4.1, УК-4.2, УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
4. III. Стилистические аспекты перевода				
4.1	**Выполнение практических заданий (Пр).** Преобразования на уровне синтаксиса. Роль грамматического оформления при переводе. Изменение структуры предложений при переводе. Грамматический практикум по переводу с изменением структуры предложений при переводе.	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2

4.2	**Выполнение практических заданий (Пр).** Членение предложений. Объединение предложений при переводе. Передача отрицательных предложений. Радиоэлектронное устройство, его составляющие. Грамматический практикум по переводу с изменением структуры предложений при переводе.	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
4.3	**Выполнение домашнего задания (Ср).** Реферативный перевод научно-технического текста с использованием приемов членения и объединения предложений.	6	3,625	УК-4.1, УК-4.2
4.4	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	6	3,625	УК-4.1, УК-4.2
4.5	**Выполнение практических заданий (Пр).** Деловое письмо. Виды деловых писем. Общие правила официальной переписки. Стиль деловой переписки. Структура делового письма. Содержание делового письма. Принцип работы и устройство контрольно-измерительного оборудования, применяемого для контроля параметров изделий "система в корпусе"	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
4.6	**Выполнение практических заданий (Пр).** Орфография и пунктуация делового письма. Лексика делового письма. Синтаксис делового письма. Лексические сокращения. Практикум по переводу деловых писем. выявление типа делового письма, особенностей стиля и клише. Правила настройки и регулировки контрольно-измерительного оборудования для контроля параметров изделий "система в корпусе"	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
4.7	**Выполнение домашнего задания (Ср).** Написание делового письма.	6	3,625	УК-4.1, УК-4.2
4.8	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	6	3,625	УК-4.1, УК-4.2
4.9	**Выполнение практических заданий (Пр).** Научно-технический стиль. Особенности перевода научно-технических текстов. Перевод заголовков. Практикум по определению лексико-грамматических особенностей научно-технического текста.	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
4.10	**Выполнение практических заданий (Пр).** Структура научно-технической статьи. Практикум по определению логически связанных подразделений (постановка задачи, изложение хода решения, анализ полученных результатов) в содержательной части технической статьи.	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
4.11	**Выполнение домашнего задания (Ср).** Перевод заголовков статей и аннотационных абзацев к ним из научных и технических журналов. Перевод содержательной части статьи с определением трех логически связанных подразделений.	6	3,625	УК-4.1, УК-4.2

4.12	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	6	3,625	УК-4.1, УК-4.2
4.13	**Выполнение практических заданий (Пр).** Терминологическая группа. Перевод базового слова. Последовательный перевод левых уточняющих определений. Практикум по определению границ терминологической группы и ее структурных элементов.	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
4.14	**Выполнение практических заданий (Пр).** Грамматический анализ научного текста. Смысловое содержательное зерно. Грамматический практикум по разбору предложений, содержащих терминологические группы.	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
4.15	**Выполнение домашнего задания (Ср).** Перевод аутентичных текстов, содержащих терминологические группы. Редактирование автоматического перевода аутентичного технического текста.	6	3,625	УК-4.1, УК-4.2
4.16	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	6	3,625	УК-4.1, УК-4.2
5. IV. Перевод технической литературы				
5.1	**Выполнение практических заданий (Пр).** Полный письменный перевод научно-технической литературы. Реферативный перевод. Аннотационный перевод. Практикум по реферативному переводу технического текста	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
5.2	**Выполнение практических заданий (Пр).** Контрольно-измерительное оборудование, применяемое для контроля параметров изделий "система в корпусе". Практикум по реферативному переводу технического текста	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
5.3	**Выполнение домашнего задания (Ср).** Реферативный перевод аутентичного научно-технического текста: «Статистическая обработка измеренных параметров изделий "система в корпусе" в процессе сборки пассивной части схемы».	6	3,625	УК-4.1, УК-4.2
5.4	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	6	3,625	УК-4.1, УК-4.2
5.5	**Выполнение практических заданий (Пр).** Перевод технической документации. Реферативный перевод текста: «Техническая документация на контрольно-измерительное оборудование, применяемое для контроля параметров изделий "система в корпусе"»	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2

5.6	**Выполнение практических заданий (Пр).** Перевод технической документации. Реферативный перевод текста: «Требования законодательства Российской Федерации, технических регламентов, сводов правил, стандартов в области испытаний изделий "система в корпусе"»	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
5.7	**Выполнение домашнего задания (Ср).** Аннотационный перевод аутентичного научно-технического текста «Правила настройки и регулировки контрольно-измерительного оборудования для контроля параметров изделий "система в корпусе"».	6	3,625	УК-4.1, УК-4.2
5.8	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	6	3,625	УК-4.1, УК-4.2
5.9	**Выполнение практических заданий (Пр).** Перевод технических инструкций. Работа с текстом: «Настройка и калибровка измерительного оборудования для проведения измерений изделий "система в корпусе"»	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
5.10	**Выполнение практических заданий (Пр).** Перевод технических инструкций. Работа с текстом: «Физико-химические параметры материалов, применяемых для изготовления изделий "система в корпусе"».	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
5.11	**Выполнение домашнего задания (Ср).** Реферативный перевод аутентичного научно-технического текста: «Качество сборки пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"».	6	3,625	УК-4.1, УК-4.2
5.12	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	6	3,625	УК-4.1, УК-4.2
5.13	**Выполнение практических заданий (Пр).** Перевод технических инструкций: «Шкафы с низкой плотностью компоновки элементов, блоки с высокой плотностью компоновки элементов и пассивные объединительные печатные платы в электронных справочных системах и библиотеках».	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
5.14	**Выполнение практических заданий (Пр).** Перевод технических инструкций: «Качество сборки пассивной части схемы и трассировки коммутационных плат изделий "система в корпусе"».	6	2	УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
5.15	**Выполнение домашнего задания (Ср).** Аннотационный перевод аутентичного научно-технического текста.	6	3,625	УК-4.1, УК-4.2
5.16	**Подготовка к аудиторным занятиям (Ср).** Повторение пройденного материала	6	3,625	УК-4.1, УК-4.2

6. Промежуточная аттестация (зачёт)				
6.1	**Подготовка к сдаче промежуточной аттестации (Зачёт).**	6	17,75	УК-4.1, УК-4.2, УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2
6.2	**Контактная работа с преподавателем в период промежуточной аттестации (КрПА).**	6	0,25	УК-4.1, УК-4.2, УК-4.3, ПК-2.1, ПК-2.2, ПК-1.2, ПК-1.3, ПК-3.1, ПК-3.2

5. ОЦЕНОЧНЫЕ МАТЕРИАЛЫ

5.1. Перечень компетенций

Перечень компетенций, на освоение которых направлено изучение дисциплины «Технический английский язык», с указанием результатов их формирования в процессе освоения образовательной программы, представлен в п.3 настоящей рабочей программы

5.2. Типовые контрольные вопросы и задания

I. УК-4.3, ПК-2.1, ПК-2.2, ПК-3.1, ПК-3.2, ПК-1.2, ПК-1.3

1. Give Russian equivalents to the following phrases:
to subject the forces, to lay the foundation, exact sciences
2. Give Russian equivalents to the following phrases:
in this connection, in this sense, to give birth
3. Give Russian equivalents to the following phrases:
as it is stated above, resulting interaction, in the course of time
4. Give Russian equivalents to the following phrases:
to confront the engineer with various problems, subsequent effect, applied mechanics
5. Give Russian equivalents to the following phrases:
manufacture and operation, branch of physics, to be based on certain principles
6. Give Russian equivalents to the following phrases:
the behaviour of physical bodies, what is now known as, by mechanical interaction we mean
7. Give Russian equivalents to the following phrases:
to take place, physical measure, according to the above mentioned problems
8. Give Russian equivalents to the following phrases:
classical mechanics, physics, mathematics
9. Give Russian equivalents to the following phrases:
principles of kinematics, statics, dynamics
10. Give Russian equivalents to the following phrases:
kinetics, structure, design
11. Give Russian equivalents to the following phrases:
absolute deformation, calculation, coordinate system
12. Give Russian equivalents to the following phrases:
reference frame, acceleration, to a certain degree, in such a way
13. Give Russian equivalents to the following phrases:
to take into account, on the one hand, relative displacement
14. Give Russian equivalents to the following phrases:
in terms of, to predict the acceleration of objects, solid body
15. Give Russian equivalents to the following phrases:
on the other hand, gaseous body, absolute and relative equilibrium
16. Give Russian equivalents to the following phrases:
state of rest, to be of great importance, liquid body

17. Give Russian equivalents to the following phrases:
in order to, transmission of motion, path, velocity, acceleration
18. Give Russian equivalents to the following phrases:
to deal with motion, the behaviour of solid bodies, manufacture and maintenance
19. Give Russian equivalents to the following phrases:
effect forces upon matter, plastic and elastic deformation, in order to evaluate
20. Give Russian equivalents to the following phrases:
manufacturing plant, fatigue failure, applied force
21. Give Russian equivalents to the following phrases:
crack on the surface, to cause the ultimate failure, technical drawing
22. Give Russian equivalents to the following phrases:
assembly notes, to push the boundaries, the ability to overcome all the constraints
23. Give Russian equivalents to the following phrases:
tribology, to achieve design goals, thermal environment
24. Give Russian equivalents to the following phrases:
the ability to withstand the forces, microfabrication, known forces
25. Give Russian equivalents to the following phrases:
electrical engineering, unlike charges, owing to
26. Give Russian equivalents to the following phrases:
forerunner, continuous current, static charge
27. Give Russian equivalents to the following phrases:
generally speaking, to be familiar with, lightning flash
28. Give Russian equivalents to the following phrases:
the ability of attracting light objects, to possess the property, more or less
29. Give Russian equivalents to the following phrases:
to find practical application, to discover the phenomenon, to charge with electricity
30. Give Russian equivalents to the following phrases:
owing to, to be the subject of scientific interest, to detect the presence of charged objects
31. Give Russian equivalents to the following phrases:
lightning conductor, discharge of electricity, due to
32. Give Russian equivalents to the following phrases:
electric current, numerous scientists, to contribute greatly
33. Give Russian equivalents to the following phrases:
to determine the difference, to investigate the connection, by means of
34. Give Russian equivalents to the following phrases:
electric quantity, resistance and voltage, to make valuable discoveries
35. Give Russian equivalents to the following phrases:
the alternating current, wiring, the long distance power transmission
36. Give Russian equivalents to the following phrases:
electric circuit, negative charge, to move under the action of an electric force
37. Give Russian equivalents to the following phrases:
to flow through the electric circuit, a complete path, under certain conditions
38. Give Russian equivalents to the following phrases:
the presence of a source of supply, load, to deliver electric current
39. Give Russian equivalents to the following phrases:
it should be noticed, the advantage of alternating current, conductor
40. Give Russian equivalents to the following phrases:
inductance coil, capacitor, resistor
41. Give Russian equivalents to the following phrases:
essential circuit components, closed and open circuits, linear and non-linear installations
42. Give Russian equivalents to the following phrases:
series and shunt installations, single-phase and polyphase systems, the order of the connection
43. Give Russian equivalents to the following phrases:
direct current, to change direction, low voltage
44. Give Russian equivalents to the following phrases:

high voltage, to increase voltage, numerous industrious purposes
45. Give Russian equivalents to the following phrases:
low voltage, insulation, electromagnetic induction, on the base of
46. Give Russian equivalents to the following phrases:
due to the efforts of scientists, applied physics, flow of electrons
47. Give Russian equivalents to the following phrases:
scientific research, industrial designing, to calculate the trajectories of spaceships
48. Give Russian equivalents to the following phrases:
due to electronics, the starting point, to assist in manipulation of signals
49. Give Russian equivalents to the following phrases:
rapid growth, the creation of early computers, to replace completely
50. Give Russian equivalents to the following phrases:
a piece of semiconductor, to reduce weight, to reduce cost
51. Give Russian equivalents to the following phrases:
power consumption, high reliability, solid state components
52. Give Russian equivalents to the following phrases:
microwave communication systems, semiconductor technology, a field of science
53. Give Russian equivalents to the following phrases:
integrated circuit, batch processing, assembling discrete components on a chip
54. Give Russian equivalents to the following phrases:
to lower manufacturing costs, to provide high speed and reliability, signals manipulation
55. Give Russian equivalents to the following phrases:
circuit functions, communication systems, data processing systems
56. Give Russian equivalents to the following phrases:
circuit application, a science field, process control
57. Give Russian equivalents to the following phrases:
circuit components, size reduction, communication means
58. Give Russian equivalents to the following phrases:
electronics development, problem solution, energy distribution
59. Give Russian equivalents to the following phrases:
intensive efforts, to increase the reliability, to reduce size and cost
60. Give Russian equivalents to the following phrases:
quantitative and qualitative changes, film technique, semiconductor technique
61. Give Russian equivalents to the following phrases:
to reduce circuit elements, the point of the miniaturization is to, to make circuits long-lasting
62. Give Russian equivalents to the following phrases:
extremely high speed of response, the smaller – the faster, advantage
63. Give Russian equivalents to the following phrases:
benefit, reduction of distances between circuit components, large-scale IC
64. Give Russian equivalents to the following phrases:
microwave integrated circuit, wave guide, circuit pattern
65. Give Russian equivalents to the following phrases:
to extend man's intellectual power, dielectric waveguide integrated circuits, current capacity
66. Give Russian equivalents to the following phrases:
packing density, associated documentation, service information
II. Lexico-grammatical test. УК-4.1, УК-4.3, ПК-2.1, ПК-2.2, ПК -3.1, ПК-3.2, ПК-1.2, ПК-1.3
1. ……. serves a model for exact sciences.
a) physics;
b) mathematics;
c) mechanics;
d) philosophy.
2. The science that studies the motion of bodies under the action of forces is ……..
a) statics;
b) mechanics;

c) kinetics;
d) kinematics
3. The person who operates and repairs various mechanisms is ……...
a) a designer;
b) an engineer;
c) a mechanic;
d) a worker
4. Equilibrium means the state of rest of a body to other ……. bodies.
a) relative;
b) receptive;
c) repulsive;
d) repaired
5. Engineers use the ……. to locate a moving body.
a) specified loads;
b) reference frame;
c) specific gravity;
d) subsequent effect
6. The state of …….. of motion of a given body depends on its mechanical interaction with other bodies.
a) comfort;
b) equilibrium;
c) rest;
d) change
7. Deformation plays a great role in ……of the strength of engineering structure.
a) introduction;
b) transmission;
c) calculation;
d) gravitation
8. It is ……. who first came to the discovery of the principle of displacement
a) Lomonosov;
b) Newton;
c) Kepler;
d) Archimedes
9. Mechanical ……. is the reciprocal action of bodies.
a) interception;
b) interaction;
c) interposition;
d) interrelation
10. The Moscow University was founded in the middle of the ….. century.
a) 16-th;
b) 17-th;
c) 18-th;
d) 20-th
11. The science dealing with the general laws of motion and equilibrium is called …… mechanics.
a) classical;
b) theoretical;
c)fluid;
d)practical
12. Every machine has ……. on which the other parts are mounted.
a) a piston;
b) a cam;
c) a key;
d) frame
13. To design the intake system for the engine …… is used.
a) dynamics;

b) fluid mechanics;
c) mechanics of materials:
d) kinematics
14. Such properties as thermal conductivity and specific heat refer to …… properties of materials.
a) mechanical;
b) physical;
c) mathematical;
d) chemical
15. The property of breaking the material without any deformation is called ……. .
a) elasticity;
b) plasticity;
c) ductility;
d) brittleness
16. The development of the science of strength of materiall began with …… .
a) Archemedes;
b) Galileo;
c) Newton;
d) Lomonosov
17. From the earliest times people studied the …… of structural materials to draw up the rules determining safe dimensions of material elements.
a) strength;
b) size;
c) composition;
d) force
18. It is known that……. studies the use and transformation of energy.
a) structural engineering;
b) dynamics:
c) thermodynamics;
d) mechanics
19. Mechanical engineers should know the properties of the materials used …… failures.
a) to protect;
b) to prevent;
c) to perform;
d) to prepare
20. Structural failures often occur because of …… in the objects.
a) impeachments;
b) imperfections;
c) impossibilities;
d) fractures
21. According the Ohm's law …… equal voltage divided by current, and ….. equals current times resistance.
a) capacity
b) resistance
c) voltage
d) current
22. The …… serves to measure the value of current in the circuit.
a) voltmeter
b) wattmeter
c) ammeter
d) conductor
23. The insulation resistance of any installation should be regularly checked ……. measuring devices.
a) in case
b) according to
c) in spite of

d) by means of
24. Transformers are widely used to ……. power.
a) receive
b) reduce
c) replace
d) result
25. Generators change …….. energy into electricity.
a) chemical
b) heat
b) mechanical
d) atomic
26. Free electrons move through the metal under the action of ……..
a) DC
b) AC
c) e.m.f.
d) unlike charges
27. An alternating current can be transformed into a …… current for practical application.
a) secondary
b) direct
c) pulsating
d) induced
28. Ohm discovered a dependence between electric ….. .
a) theories
b) effects
c) quantities
d) notions
29. The law about the force of interaction between motionless electrical …… was established by Coulomb.
a) processes
b) charges
c) circuits
d) phases
30. The electric current is a number of ……. which flow in a circuit per unit of time.
a) protons
b) electrons
c) neutrons
d) atoms
31. The method of ……. all functional categories to one another represents the functional organization of a computer.
a) showing
b) relating
c) performing
d) entering
32. Instructions and data are fed through the ….. equipment to the …… .
a) output
b) memory
c) input
d) control
33. The main units of the computer communicate with each other ….. a machine language.
a) in spite of
b) because of
c) by means of
d) in connection with
34. The control unit serves for …… orders.
a) reading

b) interpreting
c) inputting
d) storing
35. The four ….. are used to perform basic operations in a computer.
a) basics
b) circuits
c) tools
d) means
36. A computer can solve very complex numerical ……
a) communication
b) computations
c) instructions
d) compensation
37. Numbers and instructions forming the program are …. in the memory.
a) solved
b) supplied
c) simulated
d) stored
38. Any digital calculation is usually broken down into a ……. of elementary operations.
a) sequence
b) storage
c) segments
d) sections
39. The function of memory is to store ….. the original input data …… the partial results.
a) not only…. but also
b) either … or
c) neither ….. nor
d) no sooner … than
40. The ….. includes the control unit and the arithmetic-logical unit.
a) memory
b) input-output unit
c) central processor
d) arithmetic-logical unit
41. The first public demonstration of the electric telegraph discovered by …… took place on Oct. 21, 1832.
a) Morse
b) Thomson
c) Popov
d) Shilling
42. The Soviet sputnik having been launched, the USA wished ….. their superiority.
a) to receive
b) to regain
c) to remove
d) to repeat
43. As we know, the operation of the Internet is based on….. .
a) packet switching
b) probability theory
c) web browsing
d) datacards
44. A personal computer ….. to the Internet has become an important device for communicating during the past few decades.
a) concerned
b) considered
c) connected
d) conducted

45. People have dreamt of a universal …… since the end of the 19-th century.
a) data collection
b) data unit
c) data base
d) data exchange
46. A lot of Network Information Centres serve the Internet …… with the documentation, guidance, advice and assistance.
a) specialists
b) architects
c) professionals
d) users
47. One of the main …… of the World Wide Web documents is their hypertext structure.
a) characters
b) characteristics
c) concepts
d) counters
48. All the Internet services are accessible to many people …… pocket-sized devices.
a) in addition to
b) instead of
c) regardless of
d) due to
49. The Web allows users on one computer …… information stored on another through the world-wide network.
a) to address
b) to access
c) to account
d) to accomplish
50. As the popularity of the Internet increases, people become more aware of its colossal capabilities.
a) capacities
b) capabilities
c) characteristics
d) combinations
51. We suppose automation has become…………of technological progress.
a) a mechanical wonder;
b) a moving force;
c) an electromotive force;
d) a self-checking process
52. James Watt is known to invent………..
a) a load-type controller;
b) self-initiating device;
c) centrifugal speed governor;
d) weaving loom
53. Automatic control is sure to have made the………of information rapid and accurately.
a) collecting;
b) processing;
c) storing;
d) perfecting
54. It is known that automatic control system is formed by connecting automatic machines with……….
a) self-feeding process;
b) automatic assembly;
c) control engineering;
d) automatic controls
55. Many special devices make highly precise calculations…… automation.
a) due to;

b) according to;
c) because of;
d) in spite of
56. Increasing the strength of current power………are widely used in voltage dividers.
a) detectors;
b) potentiometers;
c) transducers;
d) amplifiers
57. Automatic control systems………… people of many monotonous activities.
a) require;
b) relieve;
c) revise;
d) relax
58. Without knowing the basic elements of the ACS it is impossible to regulate…………. its components.
a) completely;
b) independently
c) properly;
d) mechanically
59. ……… are said to be electromagnetic devices controlling the action of other devices in a circuit. They can also operate as switches.
a) capacitors;
b) conductors;
c) resistors;
d) relays
60. ………… the stability of a feedback path an engineer could perfect the stability of the whole system.
a) being improved;
b) having improved;
c) having been improved;
d) to improve
61. It is known that W. Thomson invented the …….
a) induction coil
b) sending key
c) tuning circuit
d) mirror galvanometer
62. The method of ….. modulation gives the possibility to transmit a lot of telephone conversations over the same wire simultaneously.
a) accuracy
b) frequency
c) currency
d) reliability
63. The first postal system with papyrus letters was organized by the …….
a) Romans
b) Egyptians
c) British
d) Russian
64. The aim of any form of ……. is to provide complete understanding of a message.
a) communication
b) calculation
c) computation
d) completion
65. It was …….. who invented transmitting and receiving coils and described the possibility of wireless communication.
a) Marconi

b) Hertz
c) Popov
d) Tesla
III. Rendering the article. УК-4.2, УК-4.1, УК-4.3
1. Give the English equivalent to the following phrase:
статья начинается с…..
2. Give the English equivalent to the following phrase:
статья посвящена проблеме…
3. Give the English equivalent to the following phrase:
статья предоставляет нам информацию о…
ответ: the article under review gives us a sort of information about…
4. Give the English equivalent to the following phrase:
тема статьи….
5. Give the English equivalent to the following phrase:
в начале статьи автор описывает…
6. Give the English equivalent to the following phrase:
в начале статьи автор объясняет…
7. Give the English equivalent to the following phrase:
в начале статьи автор касается …
8. Give the English equivalent to the following phrase:
в начале статьи автор анализирует…
9. Give the English equivalent to the following phrase:
в начале статьи автор комментирует…
10. Give the English equivalent to the following phrase:
в начале статьи автор характеризует…
11. Give the English equivalent to the following phrase:
в начале статьи автор раскрывает…
12. Give the English equivalent to the following phrase:
в начале статьи автор подчеркивает …
13. Give the English equivalent to the following phrase:
статья начинается с описания….
14. Give the English equivalent to the following phrase:
статья начинается с анализа…
15. Give the English equivalent to the following phrase:
затем автор переходит к…
16. Give the English equivalent to the following phrase:
далее, автор дает полный анализ….
17. Give the English equivalent to the following phrase:
автор продолжает утверждать, что…
18. Give the English equivalent to the following phrase:
в конце автор описывает…
19. Give the English equivalent to the following phrase:
в заключении, автор…
20. Give the English equivalent to the following phrase:
в конце статьи автор приходит к заключению…
IV. Business correspondence
1. Give the English equivalent to the following phrase:
Пишу, чтобы поблагодарить Вас за...
2. Give the English equivalent to the following phrase:
очень любезно с вашей стороны
3. Give the English equivalent to the following phrase:
Я благодарен Вам за присылку этой чрезвычайно важной и идеально составленной информации по...
4. Give the English equivalent to the following phrase:
Благодарим за столь большой вклад в...

5. Give the English equivalent to the following phrase:
К большому сожалению, сообщаем, что...
6. Give the English equivalent to the following phrase:
Мы извиняемся за ...
7. Give the English equivalent to the following phrase:
Хочу принести свои самые искренние извинения за...
8. Give the English equivalent to the following phrase:
Я искренне сожалею, что...
9. Give the English equivalent to the following phrase:
Извините, но я не могу помочь Вам в этом деле.
10. Give the English equivalent to the following phrase:
Мы очень рады, что...
11. Give the English equivalent to the following phrase:
С удовольствием...
12. Give the English equivalent to the following phrase:
Рад выслать Вам экземпляр..
13. Give the English equivalent to the following phrase:
Буду счастлив обсудить с Вами...
14. Give the English equivalent to the following phrase:
Нам было очень приятно узнать, что Вы решили предпринять...
15. Give the English equivalent to the following phrase:
Нам было приятно узнать из Вашего письма, что Вы решили...
16. Give the English equivalent to the following phrase:
Мы очень рады, что Вы пожелали купить...
17. Give the English equivalent to the following phrase:
Мы ценим вашу позицию.
18. Give the English equivalent to the following phrase:
Просим оплатить...
19. Give the English equivalent to the following phrase:
Пожалуйста, укажите Ваш почтовый индекс и номера телефона.
20. Give the English equivalent to the following phrase:
Сделайте, пожалуйста, все возможное, чтобы привести это дело к скорому положительному финалу.
21. Give the English equivalent to the following phrase:
Мы будем благодарны Вам за сообщение Вашего решения относительно...
22. Give the English equivalent to the following phrase:
Просим у Вас некоторую дополнительную информацию о..
23. Give the English equivalent to the following phrase:
Мы получили Ваше письмо от...
24. Give the English equivalent to the following phrase:
В соответствии с Вашим запросом от..
25. Give the English equivalent to the following phrase:
В ответ на Ваше письмо от... мы рады сообщить Вам, что...
26. Give the English equivalent to the following phrase:
Мы будем очень рады, если Вы сможете известить нас
27. Give the English equivalent to the following phrase:
Будем рады, если Вы напишете нам о том, что касается...
28. Give the English equivalent to the following phrase:
После моего разговора с Вашим представителем...
29. Give the English equivalent to the following phrase:
Я рассчитываю на сотрудничество с Вами в этом новом предприятии
30. Give the English equivalent to the following phrase:
Мы были бы очень благодарны, если бы Вы ответили при первой возможности

V. УК-4.1, УК-4.3, ПК-2.1, ПК-2.2, ПК -3.1, ПК-3.2, ПК-1.2, ПК-1.3
Read the sentences and fill the gaps with the following words:

1. number, electrons, circuit,
As it is known, in any metal there is a large ____ of free electrons of negative charge which can move through the metal under the action of an electric force. This flow of ____ is the electric current. A difference of electrical potential maintains a flow of electrons in conductor. The electric current flows through the electric ___, a complete path, which carries a directed flow of electric charges under certain conditions.
2. supply, generation, circuit
The necessary conditions mean the presence of the source of ___ for an electromotive force ___ and the load to which the electric current is delivered. Numerous conductors, resistors, fuses, inductance coils, throttles, capacitors, etc. , are also included to the list of essential electric ___ components.
3. polyphase, electrical, circuits
The most popular circuit models are represented in ___ engineering by numerous electronic schemes, such as closed and open ___, serious and shunt circuits, linear and non- linear installations, single-phase and ___ systems.
4. current, direct, alternating
It should be noticed that there are different types of electric ___. The current moving steadily in one direction only is a ___ current (DC). The current that changes its direction is called an ___ current (AC).
5. direct, noticed, alternating
The electrical systems in automobiles and airplanes, as well as the telegraph, telephone, the tram and special laboratories require the ___ current for their operation. But it should be ___ that about 90% of electrical energy generated at present is the ____ current.
6. voltage, advantages, hand
One of the great ___ of alternating current is the ease with which power at low ___ can be changed into power at high voltage and vice versa. Hence, on the one ___ alternating voltage can be increased when it is necessary for long-distance energy transmission and, on the other hand, one can decrease it to meet industrial requirements.
7. versorium, scientific, charged
Electricity has been the subject of ___ interest since the early 17-th century. The first electrical engineer was probably William Gilbert, who designed the ___, a device that detected the presence of statically ___ objects.
8. discharge, electricity, conductor
The famous American scientist Benjamin Franklin experimented with atmospheric ___ and proved that lightning was a ___ of electricity. He invented the lightning ___, a metal device which protected buildings from lightning by conducting the electrical charges to the earth.
9. pile, electric, contributed
The famous Italian scientist Alessandro Volta was the first to get the ___current. He constructed the voltaic ___, the first source of continuous current, a forerunner of the electric battery, in 1800. Since that time numerous scientists and inventors, Russian and foreign, have greatly ___ to the development and practical application of electricity.
10. charges, electro-dynamics, by means
Soon Andre Ampere, one of the founders of ___, determined the difference between the current and the static ___. He investigated the connection between electricity and magnetism and proved that magnetic effect could be produced without magnets, ___ of electricity alone. He also created the first theory of magnetism.
VI. Rendering (УК-4.1, УК-4.3, ПК-2.1, ПК-2.2, ПК -3.1, ПК-3.2, ПК-1.2, ПК-1.3)

1. Make a summary of the text using the phrases for rendering the article
The intensive effort of electronics to increase the reliability and performance of its products while reducing their size and cost has led to the results that hardly anyone would have dared to predict.
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.
It all began with the development of the transistor.

Prior to 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 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 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 inside solid bodies. The goal of creating electronic circuits with entirely solid-state components had finally been realized.

Early transistors, which were often described as being a size of a pea (горошина), were actually enormous on the scale at which electronic events take place, and therefore they were very slow. They could respond at a rate 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 transistors and other circuit elements to dimensions almost invisible to unaided eye (невооруженный глаз).

The point 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 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 attainable.

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 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 by the use of ever larger numbers of components and they continue to evolve. Modern scientific and business computers, for example, contain 109 elements; electronic switching systems contain more than a million components.

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

A more serious shortcoming was that it was once the universal practice to manufacture each of the components separately and then assemble the complete device by wiring the components together with metallic conductors. It was no good: the more components and interactions, me less reliable the system.

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

What ultimately provided the solution was the semiconductor integrated circuit, the concept 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 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 components. The major difference is that all these elements and their interconnections are now fabricated on a single substrate in a single series of operations.

2. Make a summary of the text using the phrases for rendering the article

Several key developments were required before the exciting potential of integrated circuits could be

realized.
The development of microelectronics depended on the invention of techniques 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 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 in their operation. They are also known as junction 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 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 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 yield) has doubled every year. The 1980 state of art 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. The circuitry defining a logic array 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 of medium-scale integrated circuits technology is marked 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 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 waferscale integration (WSI).
The change in scale can be measured by counting the number of transistors that can be fitted onto a chip.
Continued evolution of the microcomputer will demand further increases in packing density.
There appeared a new mode of integrated circuits, microwave integrated circuits. In broadest sense, a microwave integrated circuit is any combination of circuit functions which are packed together without a user accessible interface.
The evolution of microwave integrated circuits must begin with the development of planar transmission lines.
As we moved into the 1970's, strip line 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 integrated-circuit components in a transmission line called fineline appeared. Other more exotic techniques, such as dielectric waveguide64 integrated circuits emerge. 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 resolution66 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 man's intellectual power. Microelectronics extends that power still further.

3. Make a summary of the text using the phrases for rendering the article
The potential of integrated circuits is so wide that in addition to replacing similar discrete component circuits they are responsible for creating a completely new technology of circuit design.
There are two basic approaches to modern microelectronics — 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 elements are interconnected by metallic stripes deposited onto the oxidized surface of the silicon wafer.
Monolithic IC technology is an extension of the diffused planar 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.

4. Make a summary of the text using the phrases for rendering the article
In microelectronics, the steady reduction of IC feature sizes, accompanied by high current densities and increasing demands on electrical performance, has focused the attention of technologists on newer materials which exhibit characteristics such as low contact resistance, reduced vulnerability to electromigration, and processibility at low temperatures.
Over the years, the device size has been reduced tremendously. Improvements available 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 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 associated with the interconnections can play a significant role in determining 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 allows the chip area to increase, causing the lengths of the interconnections to increase. The net effect of this "scaling of interconnections" is reflected into an appreciable 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 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 one. Therefore, new materials are required for VLSI interconnections.

The design 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 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 semiconductor properties but of these Ge and Si (and to a lesser extent Se) alone have shown chemical and electrical properties suitable for electronic devices operating near room temperature.
Germanium and silicon were the first semiconductor materials in common use.
A great contribution 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 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 in p-n junctions.
Right after World War П, physicists John Bardeen, Walter Brattain and William Shockley, and many other scientists, turned 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 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 negative or positive type semiconductor material.
The early history of modern semiconductor technology can be traced 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 of polycrystalline material.
G.K.Teal originally recognized the immense importance of single-crystal semiconductor materials as well as for providing the physical realization of the junction transistor. Teal reasoned in 1949, that polycrystalline germanium's uncontrolled resistances and electronic traps would affect transistor operations in uncontrolled ways. Additionally, he reasoned that polycrystalline material would provide inconsistent product yields and thus be costly. He was the first to define chemical purity, high degree of crystal perfection and uniformity of structure as well as controlled chemical composition (i.e. donor or acceptor concentration) of the single-crystal material as an essential foundation for semiconductor products.
The next decade witnessed an ingermanium and the "universal" semiconductor material, silicon.
Silicon gradually gained favour over germanium as the "universal" semiconductor material.
Silicon is to the electronics revolution what steel was to the Industrial Revolution

5. Make a summary of the text using the phrases for rendering the article
Silicon has been the backbone (основа) of the semiconductor industry since the inception of commercial39 transistors and other solid-state devices.
The dominant role of silicon as a material for microelectronic circuits is attributable in large part to the properties of its oxide. Silicon dioxide is a clear glass with a softening point higher than 1,400 degrees C. If a wafer of silicon is heated in an atmosphere of oxygen or water vapour, a film of silicon oxide forms on its surface. The film considered is hard and durable and adheres 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 for selective introduction of dopants.
Silicon's larger band gap permitted 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 diffusion mask" for common dopants, and as insulator coating for conductor overlayers.
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 effects. The detrimental effects can be reduced if the oxygen is maintained at less than 38 ppms. Thus, the oxygen range 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 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 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 105 to 106 per chip.
To increase further the speed of semiconductor devices requires not only refinements in present designs and fabrication techniques, but also new materials that are inherently 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 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 in a new gallium arsenide-germanium hetero-junction diode. The hetero-junction device has a potential for much faster switching than conventional 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 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 device.

6. Make a summary of the text using the phrases for rendering the article
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.

7. Make a summary of the text using the phrases for rendering the article

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.

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.

8. Make a summary of the text using the phrases for rendering the article

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 lattice1 of the substance.

In an insulator all the electrons are tightly bound to atoms or molecules and hence none are available to serve as a carrier of electric charge. The situation in a semiconductor is intermediate between the two: free charge carriers are not ordinarily present, but they can be generated with a modest expenditure of energy.

Semiconductors are similar to insulators in that they have their lower bands completely filled. 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 of the band 1 (the valence band) to the bottom of band 2 (the conducting band). Below 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 conductor of electricity. Thus, conductivity poses a problem.
Several other requirements are imposed on materials. The basic demand appears to be conductivity because it can substantially improve 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 one first. To improve 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 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 for the semiconductor atoms at regular sites in the crystal lattice and move into the interior of the crystal by jumping from one site to an adjacent vacancy.
Silicon crystals may be doped with different elements. Suppose silicon is doped with boron. Each atom inserted in the silicon lattice creates a deficiency of one electron, a state that is called a hole. A hole also remains associated with an impurity atom under ordinary circumstances but can become mobile in response to an applied voltage. The hole is not a real particle, of course, but merely the absence of an electron at a position where one would be found in a pure lattice of silicon atoms. Nevertheless 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 moves through a liquid medium. An adjacent atom transfers 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 in which n -type or p-type regions are to be created in certain areas, the adjacent areas are protected by surface layer of silicon dioxide, which effectively blocks the passage of impurity atoms. This protective layer is created very simply by exposin1 the silicon wafer at high temperature to an oxidizing atmosphere. The silicon dioxide is then etched away in conformity with a sequence of masks that accurately delineates multiplicity of n-type and p-type regions.
To define the microscopic regions that are exposed to diffusion in various stages of the process, extremely precise photolithographic procedures 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 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 the ultraviolet radiation from reaching the organic coating the coating is removed. An etching acid 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 are likely to denote the sequence of doped regions in the silicon.
The first transistor structures were formed by alloying or diffusion in bulk 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 SiO2 interface and ease of thermal oxidation of silicon.
The recent years have seen considerable interest in the subject of oxygen and its precipitates in silicon. It has now been established48 that their presence can have a variety of effects, harmful 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 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 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, still higher device operating frequencies and more sophisticated device structures has needed continuing innovation and development.
Advances in silicon crystal growth technology have encouraged advances in the automation of crystal growing equipment. Crystal pulling equipment now available uses computer software to control all the growing parameters. Preprogrammed process changes are used to tailor crystal characteristics.

9. Make a summary of the text using the phrases for rendering the article
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 of thin films are numerous and include the following methods: evaporation, sputtering, 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 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. 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 from relatively inert molecular gases. These reactive species combine chemically with certain solid materials to form volatile 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, 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 intricate64 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 stacked65 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 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 the operations of the circuit. Besides, computer simulation is less expensive than assembling a "bread-board" 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 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 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.

10. Make a summary of the text using the phrases for rendering the article

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 submicron 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.

11. Make a summary of the text using the phrases for rendering the article

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 hightemperature 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.

12. Make a summary of the text using the phrases for rendering the article
III-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.

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 highspeed 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.

13. Make a summary of the text using the phrases for rendering the article

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

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

Nowadays computers are considered to be complicated machines for doing arithmetic and logic. The computer may be stated to have become an important and powerful tool for collecting, recording, analysing, and distributing6 tremendous masses of information.

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

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 all its accomplishments, 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 the processing of large amounts of information that is not performed by a computer. In science computers digest and analyse masses of measurements, such as the sequential positions and velocities of a spacecraft and solve extraordinary long and complex mathematical problems, such as the trajectory of the spacecraft. In commerce they record and process inventories, purchases (покупка), bills, payrolls (платежная ведомость), bank deposits and the like and keep track of ongoing business transactions. In industry they monitor 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 speed of main-memory 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 too: mid-1950's 100 thousand bits, mid-1960's 1 to 10 million, mid-1970's nearly 1 billion bits. Secondary storage 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 of their size or purpose most computer systems consist of three basic elements: the input-output ports, the memory hierarchy and the central processing unit. The input-output ports are paths whereby information (instructions and data) is fed into the computer or taken out of it by such means as punch cards, magnetic tapes and terminals. The memory hierarchy stores the instructions (the program) and the data in the system so that they can be retrieved quickly on demand by the central processing unit. The central processing unit controls the operation of the entire system by issuing commands to other parts of the system and by acting on the responses. When required it reads information from the memory, interprets 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 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 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. 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 labelled36 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 processing systems able to execute comparatively simple computing functions at lower cost.

In 1971, Intel Corp. delivered the first microprocessor, the 4004. All the logic to implement 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 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 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.
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 could make our lives easier, and indeed they already enhance the productivity. Yet a bottleneck (трудность) remains which hinders 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 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.
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 artificial language designed specifically for that system. If a user fails to use this language or makes a mistake, however small, an error message is the response he can expect.
14. Make a summary of the text using the phrases for rendering the article
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 towards languages with a free format and more error checking. Thus programming itself takes less time since fewer errors are made and residual errors are detected and corrected more rapidly. ADA seems destined 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, almost all man-machine interaction takes place through typed input and output. Superficially, at least, it is this mode that human communication needs.
However, this type of man-machine communication is rapidly becoming outmoded by a generation of powerful personal computers. These machines are intended 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 can display line drawings or images and produce attention-commanding effects such as highlighting (высвечивать) or flashing the background61 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.
It is apparent 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.
In this case data reliability is a significant design factor. More and more data are stored in machines

without paper or manual backup. 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. 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 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 the nervous system of our society.
The versatility and convenience 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 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 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. 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 processing will be common too
15. Make a summary of the text using the phrases for rendering the article
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 higher 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.
16. Make a summary of the text using the phrases for rendering the article
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.
17. Make a summary of the text using the phrases for rendering the article
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 weatherprediction 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.
18. Make a summary of the text using the phrases for rendering the article
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.
19. Make a summary of the text using the phrases for rendering the article
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 hundreds 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.
20. Make a summary of the text using the phrases for rendering the article
The microprocessor forms the heart of a microcomputer.
The first microprocessors were developed in 1971 as an offshoot of pocket calculator development. Since then there has been a tremendous upsurge of work in this field and some years later there appeared dozens 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 random 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 memory) and ROMs (read-only memory); specially designed I/O and peripheral interface

circuits; on-chips clock and timing circuits; more extensive and more powerful instruction sets and lower power dissipation.

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 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 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 will be.

As mentioned before computer actually refers to a computing system including hardware (processor, I/O circuits, power supplies, 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. 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 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 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 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 excitation18 into a corresponding 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 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. As a result, electronics based on CMOS can operate successfully with "noisy" power supplies and the low consumption makes it quite feasible to use a simple battery to maintain the security of supply for several weeks. This type of microprocessor has clear advantages over the other types if it is intended for use in exacting 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 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.

The key features to consider in any microprocessor are: word 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 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 of the system; at other times the controller may operate independently of the CPU.
21. Make a summary of the text using the phrases for rendering the article
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 sophisticated capabilities with distributed microprocessing. These "intelligent" I/O modules perform some of the calculations formerly done by the main microprocessor, store information temporarily, and do other functions under the direction of the main microprocessor.
Some remote I/O modules have microprocessors resident in the modules. Remote I/O modules use the resident mic processors to shorten the effective scan time. However, with independent intelligence 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 instructions for fail-safe shutdown should the PC develop a fault.
A trend that is beginning to emerge in microprocessor design is the incorporation of troubleshooting aids heretofore (до сих пор) available only on larger computers.
Provisions 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 need for easy methods of documenting programs and changes made to them.
Programmability- 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 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 and vice versa, more arithmetic capability such as matrix inversion, etc., and massive amounts of memory.
22. Make a summary of the text using the phrases for rendering the article
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...
23. Make a summary of the text using the phrases for rendering the article
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 on demand for long computations, for which high speed is worthwhile in the first place.
Storage devices or memories must have capacities 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" 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 between analogue and digital recording. Described here is digital memory. The most widely used digital memories are read/write memories, the term signifying 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 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. So far 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 between memories is the manner in which information is stored (written) and accessed (read). Random-access memories involve column and row matrices which allow information to be stored in any cell and accessed in approximately the same time. By contrast, "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 of tapes, disks, and drums), and on the other hand, fast electronic memories (the core memory and various types of transistor memories).

Random-access memories can complete read and write operations in specified rninimum 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 or character (usually eight or nine bits), or a word (12 to 64 bits depending on the particular system). Most memories are location-addressable, which means that a desired bit, byte or word has a specified address or physical location to which it is assigned.

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 into the input. Although it was economical, it had the inherent drawback 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 the total freedom of accessing and therefore of branching (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 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 by thousands on a grid of wires. Ferrite-core memories have now been largely succeeded 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 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 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 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 of the selected row and column is the target 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 input or output of four, eight or more bits.

24. Make a summary of the text using the phrases for rendering the article

Different categories of semiconductor memories and specific data storage applications where they find primary use provide system engineers with a wide range of options. 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 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 1012 bits accessible in nanoseconds, and still farther from the capacities of 1015 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.

Thus computers today use a hierarchy of large-capacity, relatively slow mechanically accessed memories in conjunction 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 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 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, 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.

25. Make a summary of the text using the phrases for rendering the article

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

5.3. Фонд оценочных материалов

Полный перечень оценочных материалов представлен в приложении 1.

6. МАТЕРИАЛЬНО-ТЕХНИЧЕСКОЕ И УЧЕБНО-МЕТОДИЧЕСКОЕ ОБЕСПЕЧЕНИЕ ДИСЦИПЛИНЫ (МОДУЛЯ)

6.1. МАТЕРИАЛЬНО-ТЕХНИЧЕСКОЕ ОБЕСПЕЧЕНИЕ ДИСЦИПЛИНЫ (МОДУЛЯ)

Наименование помещения	Перечень основного оборудования
Учебная аудитория для проведения занятий лекционного и семинарского типа, групповых и индивидуальных консультаций, текущего контроля и промежуточной аттестации	Мультимедийное оборудование, специализированная мебель, наборы демонстрационного оборудования и учебно-наглядных пособий, обеспечивающие тематические иллюстрации.
Помещение для самостоятельной работы обучающихся	Компьютерная техника с возможностью подключения к сети "Интернет" и обеспечением доступа в электронную информационно-образовательную среду организации.

6.2. ПЕРЕЧЕНЬ ПРОГРАММНОГО ОБЕСПЕЧЕНИЯ

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2. Microsoft Office. Договор №32009183466 от 02.07.2020 г.

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6.3.1. Основная литература

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6.4. РЕКОМЕНДУЕМЫЙ ПЕРЕЧЕНЬ СОВРЕМЕННЫХ ПРОФЕССИОНАЛЬНЫХ БАЗ ДАННЫХ И ИНФОРМАЦИОННЫХ СПРАВОЧНЫХ СИСТЕМ

1. Научная электронная библиотека http://www.elibrary.ru
2. English Grammar Online https://www.ego4u.com
3. Международный ресурс для поиска и обмена научными публикациями https://www.researchgate.net
4. База данных Web of Science http://www.webofknowledge.com

6.5. МЕТОДИЧЕСКИЕ УКАЗАНИЯ ДЛЯ ОБУЧАЮЩИХСЯ ПО ОСВОЕНИЮ ДИСЦИПЛИНЫ (МОДУЛЯ)

Самостоятельная работа студента направлена на подготовку к учебным занятиям и на развитие знаний, умений и навыков, предусмотренных программой дисциплины.

В соответствии с учебным планом дисциплина может предусматривать лекции, практические занятия и лабораторные работы, а также выполнение и защиту курсового проекта (работы). Успешное изучение дисциплины требует посещения всех видов занятий, выполнение заданий преподавателя и ознакомления с основной и дополнительной литературой. В зависимости от мероприятий, предусмотреннх учебным планом и разделом 4, данной программы, студент выбирает методические указания для самостоятельной работы из приведённых ниже.

При подготовке к лекционным занятиям студентам необходимо:
перед очередной лекцией необходимо просмотреть конспект материала предыдущей лекции. При затруднениях в восприятии материала следует обратиться к основным литературным источникам. Если разобраться в материале опять не удалось, то обратитесь к лектору (по графику его консультаций) или к преподавателю на практических занятиях.

Практические занятия завершают изучение наиболее важных тем учебной дисциплины. Они служат для закрепления изученного материала, развития умений и навыков подготовки докладов, сообщений, приобретения опыта устных публичных выступлений, ведения дискуссии, аргументации и защиты выдвигаемых положений, а также для контроля преподавателем степени подготовленности студентов по изучаемой дисциплине.
При подготовке к практическому занятию студенты имеют возможность воспользоваться консультациями преподавателя.

При подготовке к практическим занятиям студентам необходимо:
приносить с собой рекомендованную преподавателем литературу к конкретному занятию;
до очередного практического занятия по рекомендованным литературным источникам проработать теоретический материал, соответствующей темы занятия;
в начале занятий задать преподавателю вопросы по материалу, вызвавшему затруднения в его понимании и освоении при решении задач, заданных для самостоятельного решения;
в ходе семинара давать конкретные, четкие ответы по существу вопросов;
на занятии доводить каждую задачу до окончательного решения, демонстрировать понимание проведенных расчетов (анализов, ситуаций), в случае затруднений обращаться к преподавателю.

Студентам, пропустившим занятия (независимо от причин), не имеющим письменного решения задач или не подготовившихся к данному практическому занятию, рекомендуется не позже чем в 2-недельный срок явиться на консультацию к преподавателю и отчитаться по теме, изученную на занятии.

Методические указания, необходимые для изучения и прохождения дисциплины приведены в составе образовательной программы.

6.6. МЕТОДИЧЕСКИЕ РЕКОМЕНДАЦИИ ПО ОБУЧЕНИЮ ЛИЦ С ОГРАНИЧЕННЫМИ ВОЗМОЖНОСТЯМИ ЗДОРОВЬЯ И ИНВАЛИДОВ

Освоение дисциплины обучающимися с ограниченными возможностями здоровья может быть организовано как совместно с другими обучающимися, так и в отдельных группах. Предполагаются специальные условия для получения образования обучающимися с ограниченными возможностями здоровья.

Профессорско-педагогический состав знакомится с психолого-физиологическими особенностями обучающихся инвалидов и лиц с ограниченными возможностями здоровья, индивидуальными программами реабилитации инвалидов (при наличии). При необходимости осуществляется дополнительная поддержка преподавания тьюторами, психологами, социальными работниками, прошедшими подготовку ассистентами.

В соответствии с методическими рекомендациями Минобрнауки РФ (утв. 8 апреля 2014 г. N АК-44/05вн) в курсе предполагается использовать социально-активные и рефлексивные методы обучения, технологии социокультурной реабилитации с целью оказания помощи в установлении полноценных межличностных отношений с другими студентами, создании комфортного психологического климата в студенческой группе. Подбор и разработка учебных материалов производятся с учетом предоставления материала в различных формах: аудиальной, визуальной, с использованием специальных технических средств и информационных систем.

Медиаматериалы также следует использовать и адаптировать с учетом индивидуальных особенностей обучения лиц с ОВЗ.

Освоение дисциплины лицами с ОВЗ осуществляется с использованием средств обучения общего и специального назначения (персонального и коллективного использования). Материально-техническое обеспечение предусматривает приспособление аудиторий к нуждам лиц с ОВЗ.

Форма проведения аттестации для студентов-инвалидов устанавливается с учетом индивидуальных психофизических особенностей. Для студентов с ОВЗ предусматривается доступная форма предоставления заданий оценочных средств, а именно:

- в печатной или электронной форме (для лиц с нарушениями опорно-двигательного аппарата);
- в печатной форме или электронной форме с увеличенным шрифтом и контрастностью (для лиц с нарушениями слуха, речи, зрения);
- методом чтения ассистентом задания вслух (для лиц с нарушениями зрения).

Студентам с инвалидностью увеличивается время на подготовку ответов на контрольные вопросы. Для таких студентов предусматривается доступная форма предоставления ответов на задания, а именно:

- письменно на бумаге или набором ответов на компьютере (для лиц с нарушениями слуха, речи);
- выбором ответа из возможных вариантов с использованием услуг ассистента (для лиц с нарушениями опорно-двигательного аппарата);
- устно (для лиц с нарушениями зрения, опорно-двигательного аппарата).

При необходимости для обучающихся с инвалидностью процедура оценивания результатов обучения может проводиться в несколько этапов.