МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ
федеральное государственное бюджетное образовательное учреждение
высшего образования
МОСКОВСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ
ГЕОДЕЗИИ И КАРТОГРАФИИ
(МИИГАиК)

Факультет оптического приборостроения
Кафедра лингвистики

**ДОКУМЕНТ ПОДПИСАН
ЭЛЕКТРОННОЙ ПОДПИСЬЮ**

Сертификат: 5387FD2AF5B17FED816FDE9A1D4973B1
Владелец: Степанченко Алексей Леонидович
Действителен: с 21.07.2025 по 14.10.2026

«УТВЕРЖДАЮ»
Проректор
А. Л. Степанченко
16 февраля 2024 г.

ФОНД ОЦЕНОЧНЫХ СРЕДСТВ ПО ДИСЦИПЛИНЕ (МОДУЛЮ) «Б1.О.05 ИНОСТРАННЫЙ ЯЗЫК»

Уровень высшего образования: бакалавриат

Направление подготовки: 12.03.02 Оптотехника

Направленность(профиль) подготовки: Оптико-электронные приборы и системы

Квалификация (степень) выпускника: бакалавр

Форма обучения: очная

Год набора (приема на обучение): 2024

Срок получения образования: 4 года

Объем: в зачетных единицах: 6 з.е.
в академических часах: 216 ак.ч.

Москва, 2024

Разработчики:
Заведующий кафедрой Лингвистики, доцент Герасимов И. П.

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Фонд оценочных средств по дисциплине (модулю) составлен в соответствии с требованиями ФГОС ВО по направлению подготовки 12.03.02 Оптотехника, утвержденного приказом Минобрнауки от 19.02.0017 № 948

Согласование и утверждение

№	Подразделение	Ответственное лицо	ФИО	Виза	Дата, протокол (при наличии)
1	факультет Оптического приборостроения	Председатель ученого совета факультета	Торшина И. П.	Рассмотрено	15.02.2024, № 2/23-24

1. Планируемые результаты обучения, соотнесенные с планируемыми результатами освоения образовательной программы

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

УК-4.1 Выбирает стиль общения на государственном языке РФ и иностранном языке в зависимости от цели и условий партнерства; адаптирует речь, стиль общения и язык жестов к ситуациям взаимодействия

Знать:

УК-4.1/Зн1 Лексический минимум в объеме 2000 учебных лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессионального содержания из зарубежных источников

Уметь:

УК-4.1/Ум1 Выполнять переводы технических текстов с иностранного языка

Владеть:

УК-4.1/Нв1 Навыками чтения, аудирования, разговорной речи, письмо в профессиональной области.

УК-4.2 Выполняет перевод профессиональных текстов с иностранного языка на государственный язык РФ и с государственного языка РФ на иностранный

Знать:

УК-4.2/Зн1 Основные способы работы на языковым и речевым материалом

Уметь:

УК-4.2/Ум1 Выполнять перевод технических текстов с иностранного языка

Владеть:

УК-4.2/Нв1 Приемами самостоятельной работы с языковым материалом с использованием справочной и учебной литературы

УК-4.3 Ведет деловую коммуникацию в письменной и электронной форме, учитывая особенности стилистики официальных и неофициальных писем, социокультурные различия в формате корреспонденции на государственном и иностранном (-ых) языках

Знать:

УК-4.3/Зн1 нормы произношения, лексику иностранного языка общеупотребительного, терминологического и профессионального содержания; типовые способы построения высказываний в устной и письменной речи

Уметь:

УК-4.3/Ум1 осуществляет коммуникацию с зарубежными партнерами; переводит научно-техническую литературу, связанную с профессиональной деятельностью

Владеть:

УК-4.3/Нв1 стратегиями проведения сопоставительного анализа факторов культуры различных стран

УК-4.4 Представляет свою точку зрения при деловом общении и в публичных выступлениях

Знать:

УК-4.4/Зн1 лексический минимум в объеме 2000 лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессиональго содержания из зарубежных источников

Уметь:

УК-4.4/Ум1 осуществлять коммуникацию с зарубежными партнерами; переводить научно-техническую литературу по вопросами, связанным с профессиональной деятельностью

Владеть:

УК-4.4/Нв1 компенсаторными умениями, помогающими преодолеть "сбои" в коммуникации, вызванные объективными и субъективными, социокультурными причинами

УК-5 Способен воспринимать межкультурное разнообразие общества в социально-историческом, этическом и философском контекстах

УК-5.1 Интерпретирует историю России в контексте мирового исторического развития

Знать:

УК-5.1/Зн1 основные категории философии, законы исторического развития, основы межкультурной коммуникации

Уметь:

УК-5.1/Ум1 формулировать цели личностного и профессионального развития и условия их достижения, исходя из тенденций развития области профессиональной деятельности, этапов профессионального роста, индивидуально-личностных особенностей;

осуществлять личностный выбор в различных профессиональных и морально-ценностных ситуациях, оценивать последствия принятого решения и нести за него ответственность перед собой и обществом.

Владеть:

УК-5.1/Нв1 приёмами и технологиями целеполагания, целереализации и оценки результатов деятельности по решению профессиональных задач;

способами выявления и оценки индивидуально-личностных, профессионально-значимых качеств и путями достижения более высокого уровня их развития.

УК-5.2 Учитывает при социальном и профессиональном общении историческое наследие и социокультурные традиции различных социальных групп, этносов и конфессий, включая мировые религии, философские и этические учения

Знать:

УК-5.2/Зн1 основные этапы истории России и Всеобщей истории;

основные факторы социально-исторического развития, определяющие межкультурное разнообразие общества;

типы и виды исторических источников, подходы к анализу и интерпретации исторических источников;

требования и подходы сравнительно-исторического анализа

Уметь:

УК-5.2/Ум1 грамотно и доступно излагать информацию в процессе профессионального взаимодействия;

соблюдать этические нормы межкультурного взаимодействия;

анализировать и реализовывать социальное взаимодействие с учётом национальных, этнокультурных, конфессиональных особенностей оппонентов.

Владеть:

УК-5.2/Нв1 навыками сравнительно-исторического анализа социально-исторических явлений;

приёмами описания межкультурного разнообразия общества, обусловленного социально-историческими причинами и факторами.

УК-5.3 Придерживается принципов недискриминационного взаимодействия при личном и массовом общении в целях выполнения профессиональных задач и усиления социальной интеграции

Знать:

УК-5.3/Зн1 этапы исторического развития России в контексте мировой истории, социокультурные традиции мира, основные философские, религиозные и этические учения.

Уметь:

УК-5.3/Ум1 организовывать продуктивное взаимодействие в профессиональной среде с учётом национальных, этнокультурных, конфессиональных особенностей.

Владеть:

УК-5.3/Нв1 навыками общения с людьми.

УК-5.4 Применяет основные категории исторической науки и философского мировоззрения к анализу специфики различных культурных сообществ

Знать:

УК-5.4/Зн1 этапы исторического развития общества (включая основные события, деятельность основных исторических деятелей) и культурные традиции мира (включая мировые религии, философские и этические учения).

Уметь:

УК-5.4/Ум1 толерантно и конструктивно взаимодействовать с людьми с учётом их социокультурных особенностей в целях успешного выполнения профессиональных задач и усиления социальной интеграции.

Владеть:

УК-5.4/Нв1 выбор способа поведения в поликультурном коллективе при конфликтной ситуации.

2. Показатели и критерии оценивания компетенций

Планируемые результаты освоения программы	Уровень овладения	Критерии оценивания (перечень сформированных ИДК/ЗУВ по уровням освоения)
УК-4 Способен осуществлять деловую коммуникацию в устной и письменной формах на государственном языке Российской Федерации и иностранном(ых) языке(ах)	Повышенный	ИДК УК-4.1 Выбирает стиль общения на государственном языке РФ и иностранном языке в зависимости от цели и условий партнерства; адаптирует речь, стиль общения и язык жестов к ситуациям взаимодействия Знать: УК-4.1/Зн1 Лексический минимум в объеме 2000 учебных лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессионального содержания из зарубежных источников Уметь: УК-4.1/Ум1 Выполнять переводы технических текстов с иностранного языка Владеть: УК-4.1/Нв1 Навыками чтения, аудирования, разговорной речи, письмо в профессиональной области.

			ИДК УК-4.2 Выполняет перевод профессиональных текстов с иностранного языка на государственный язык РФ и с государственного языка РФ на иностранный Знать: УК-4.2/Зн1 Основные способы работы на языковым и речевым материалом Уметь: УК-4.2/Ум1 Выполнять перевод технических текстов с иностранного языка Владеть: УК-4.2/Нв1 Приемами самостоятельной работы с языковым материалом с использованием справочной и учебной литературы ИДК УК-4.3 Ведет деловую коммуникацию в письменной и электронной форме, учитывая особенности стилистики официальных и неофициальных писем, социокультурные различия в формате корреспонденции на государственном и иностранном (-ых) языках Знать: УК-4.3/Зн1 нормы произношения, лексику иностранного языка общеупотребительного, терминологического и профессионального содержания; типовые способы построения высказываний в устной и письменной речи Уметь: УК-4.3/Ум1 осуществляет коммуникацию с зарубежными партнерами; переводит научно-техническую литературу, связанную с профессиональной деятельностью Владеть: УК-4.3/Нв1 стратегиями проведения сопоставительного анализа факторов культуры различных стран ИДК УК-4.4 Представляет свою точку зрения при деловом общении и в публичных выступлениях Знать: УК-4.4/Зн1 лексический минимум в объеме 2000 лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессиональго содержания из зарубежных источников Уметь: УК-4.4/Ум1 осуществлять коммуникацию с зарубежными партнерами; переводить научно-техническую литературу по вопросами, связанным с профессиональной деятельностью

		Владеть: УК-4.4/Нв1 компенсаторными умениями, помогающими преодолеть "сбои" в коммуникации, вызванные объективными и субъективными, социокультурными причинами
	Базовый	ИДК УК-4.1 Выбирает стиль общения на государственном языке РФ и иностранном языке в зависимости от цели и условий партнерства; адаптирует речь, стиль общения и язык жестов к ситуациям взаимодействия Знать: УК-4.1/Зн1 Лексический минимум в объеме 2000 учебных лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессионального содержания из зарубежных источников Уметь: УК-4.1/Ум1 Выполнять переводы технических текстов с иностранного языка ИДК УК-4.2 Выполняет перевод профессиональных текстов с иностранного языка на государственный язык РФ и с государственного языка РФ на иностранный Знать: УК-4.2/Зн1 Основные способы работы на языковым и речевым материалом Уметь: УК-4.2/Ум1 Выполнять перевод технических текстов с иностранного языка ИДК УК-4.3 Ведет деловую коммуникацию в письменной и электронной форме, учитывая особенности стилистики официальных и неофициальных писем, социокультурные различия в формате корреспонденции на государственном и иностранном (-ых) языках Знать: УК-4.3/Зн1 нормы произношения, лексику иностранного языка общеупотребительного, терминологического и профессионального содержания; типовые способы построения высказываний в устной и письменной речи Уметь: УК-4.3/Ум1 осуществляет коммуникацию с зарубежными партнерами; переводит научно-техническую литературу, связанную с профессиональной деятельностью

		ИДК УК-4.4 Представляет свою точку зрения при деловом общении и в публичных выступлениях Знать: УК-4.4/Зн1 лексический минимум в объеме 2000 лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессиональго содержания из зарубежных источников Уметь: УК-4.4/Ум1 осуществлять коммуникацию с зарубежными партнерами; переводить научно-техническую литературу по вопросами, связанным с профессиональной деятельностью
	Пороговый	ИДК УК-4.1 Выбирает стиль общения на государственном языке РФ и иностранном языке в зависимости от цели и условий партнерства; адаптирует речь, стиль общения и язык жестов к ситуациям взаимодействия Знать: УК-4.1/Зн1 Лексический минимум в объеме 2000 учебных лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессионального содержания из зарубежных источников ИДК УК-4.2 Выполняет перевод профессиональных текстов с иностранного языка на государственный язык РФ и с государственного языка РФ на иностранный Знать: УК-4.2/Зн1 Основные способы работы на языковым и речевым материалом ИДК УК-4.3 Ведет деловую коммуникацию в письменной и электронной форме, учитывая особенности стилистики официальных и неофициальных писем, социокультурные различия в формате корреспонденции на государственном и иностранном (-ых) языках Знать: УК-4.3/Зн1 нормы произношения, лексику иностранного языка общеупотребительного, терминологического и профессионального содержания; типовые способы построения высказываний в устной и письменной речи

		ИДК УК-4.4 Представляет свою точку зрения при деловом общении и в публичных выступлениях Знать: УК-4.4/Зн1 лексический минимум в объеме 2000 лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессиональго содержания из зарубежных источников
УК-5 Способен воспринимать межкультурное разнообразие общества в социально-историческом, этическом и философском контекстах	Повышенный	ИДК УК-5.1 Интерпретирует историю России в контексте мирового исторического развития Знать: УК-5.1/Зн1 основные категории философии, законы исторического развития, основы межкультурной коммуникации Уметь: УК-5.1/Ум1 формулировать цели личностного и профессионального развития и условия их достижения, исходя из тенденций развития области профессиональной деятельности, этапов профессионального роста, индивидуально-личностных особенностей; осуществлять личностный выбор в различных профессиональных и морально-ценностных ситуациях, оценивать последствия принятого решения и нести за него ответственность перед собой и обществом. Владеть: УК-5.1/Нв1 приёмами и технологиями целеполагания, целереализации и оценки результатов деятельности по решению профессиональных задач; способами выявления и оценки индивидуально-личностных, профессионально-значимых качеств и путями достижения более высокого уровня их развития. ИДК УК-5.2 Учитывает при социальном и профессиональном общении историческое наследие и социокультурные традиции различных социальных групп, этносов и конфессий, включая мировые религии, философские и этические учения Знать: УК-5.2/Зн1 основные этапы истории России и Всеобщей истории; основные факторы социально-исторического развития, определяющие межкультурное разнообразие общества; типы и виды исторических источников, подходы к анализу и интерпретации исторических источников; требования и подходы сравнительно-исторического анализа

		Уметь: УК-5.2/Ум1 грамотно и доступно излагать информацию в процессе профессионального взаимодействия; соблюдать этические нормы межкультурного взаимодействия; анализировать и реализовывать социальное взаимодействие с учётом национальных, этнокультурных, конфессиональных особенностей оппонентов. Владеть: УК-5.2/Нв1 навыками сравнительно-исторического анализа социально-исторических явлений; приёмами описания межкультурного разнообразия общества, обусловленного социально-историческими причинами и факторами. ИДК УК-5.3 Придерживается принципов недискриминационного взаимодействия при личном и массовом общении в целях выполнения профессиональных задач и усиления социальной интеграции Знать: УК-5.3/Зн1 этапы исторического развития России в контексте мировой истории, социокультурные традиции мира, основные философские, религиозные и этические учения. Уметь: УК-5.3/Ум1 организовывать продуктивное взаимодействие в профессиональной среде с учётом национальных, этнокультурных, конфессиональных особенностей. Владеть: УК-5.3/Нв1 навыками общения с людьми. ИДК УК-5.4 Применяет основные категории исторической науки и философского мировоззрения к анализу специфики различных культурных сообществ Знать: УК-5.4/Зн1 этапы исторического развития общества (включая основные события, деятельность основных исторических деятелей) и культурные традиции мира (включая мировые религии, философские и этические учения). Уметь: УК-5.4/Ум1 толерантно и конструктивно взаимодействовать с людьми с учётом их социокультурных особенностей в целях успешного выполнения профессиональных задач и усиления социальной интеграции.

		Владеть: УК-5.4/Нв1 выбор способа поведения в поликультурном коллективе при конфликтной ситуации.
	Базовый	ИДК УК-5.2 Учитывает при социальном и профессиональном общении историческое наследие и социокультурные традиции различных социальных групп, этносов и конфессий, включая мировые религии, философские и этические учения Знать: УК-5.2/Зн1 основные этапы истории России и Всеобщей истории; основные факторы социально-исторического развития, определяющие межкультурное разнообразие общества; типы и виды исторических источников, подходы к анализу и интерпретации исторических источников; требования и подходы сравнительно-исторического анализа Уметь: УК-5.2/Ум1 грамотно и доступно излагать информацию в процессе профессионального взаимодействия; соблюдать этические нормы межкультурного взаимодействия; анализировать и реализовывать социальное взаимодействие с учётом национальных, этнокультурных, конфессиональных особенностей оппонентов. ИДК УК-5.3 Придерживается принципов недискриминационного взаимодействия при личном и массовом общении в целях выполнения профессиональных задач и усиления социальной интеграции Знать: УК-5.3/Зн1 этапы исторического развития России в контексте мировой истории, социокультурные традиции мира, основные философские, религиозные и этические учения. Уметь: УК-5.3/Ум1 организовывать продуктивное взаимодействие в профессиональной среде с учётом национальных, этнокультурных, конфессиональных особенностей.

		ИДК УК-5.4 Применяет основные категории исторической науки и философского мировоззрения к анализу специфики различных культурных сообществ Знать: УК-5.4/Зн1 этапы исторического развития общества (включая основные события, деятельность основных исторических деятелей) и культурные традиции мира (включая мировые религии, философские и этические учения). Уметь: УК-5.4/Ум1 толерантно и конструктивно взаимодействовать с людьми с учётом их социокультурных особенностей в целях успешного выполнения профессиональных задач и усиления социальной интеграции.
	Пороговый	ИДК УК-5.2 Учитывает при социальном и профессиональном общении историческое наследие и социокультурные традиции различных социальных групп, этносов и конфессий, включая мировые религии, философские и этические учения Знать: УК-5.2/Зн1 основные этапы истории России и Всеобщей истории; основные факторы социально-исторического развития, определяющие межкультурное разнообразие общества; типы и виды исторических источников, подходы к анализу и интерпретации исторических источников; требования и подходы сравнительно-исторического анализа ИДК УК-5.3 Придерживается принципов недискриминационного взаимодействия при личном и массовом общении в целях выполнения профессиональных задач и усиления социальной интеграции Знать: УК-5.3/Зн1 этапы исторического развития России в контексте мировой истории, социокультурные традиции мира, основные философские, религиозные и этические учения.

		ИДК УК-5.4 Применяет основные категории исторической науки и философского мировоззрения к анализу специфики различных культурных сообществ Знать: УК-5.4/Зн1 этапы исторического развития общества (включая основные события, деятельность основных исторических деятелей) и культурные традиции мира (включая мировые религии, философские и этические учения).

3. Шкала оценивания

Оценка	Критерии оценивания (перечень сформированных ИДК/ЗУВ)
Отлично	УК-4.1 Выбирает стиль общения на государственном языке РФ и иностранном языке в зависимости от цели и условий партнерства; адаптирует речь, стиль общения и язык жестов к ситуациям взаимодействия УК-4.1/Зн1 Лексический минимум в объеме 2000 учебных лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессионального содержания из зарубежных источников УК-4.1/Ум1 Выполнять переводы технических текстов с иностранного языка УК-4.1/Нв1 Навыками чтения, аудирования, разговорной речи, письмо в профессиональной области. УК-5.1 Интерпретирует историю России в контексте мирового исторического развития УК-5.1/Зн1 основные категории философии, законы исторического развития, основы межкультурной коммуникации УК-5.1/Ум1 формулировать цели личностного и профессионального развития и условия их достижения, исходя из тенденций развития области профессиональной деятельности, этапов профессионального роста, индивидуально-личностных особенностей; осуществлять личностный выбор в различных профессиональных и морально-ценностных ситуациях, оценивать последствия принятого решения и нести за него ответственность перед собой и обществом. УК-5.1/Нв1 приёмами и технологиями целеполагания, целереализации и оценки результатов деятельности по решению профессиональных задач; способами выявления и оценки индивидуально-личностных, профессионально-значимых качеств и путями достижения более высокого уровня их развития. УК-4.2 Выполняет перевод профессиональных текстов с иностранного языка на государственный язык РФ и с государственного языка РФ на иностранный УК-4.2/Зн1 Основные способы работы на языковым и речевым материалом УК-4.2/Ум1 Выполнять перевод технических текстов с иностранного языка УК-4.2/Нв1 Приемами самостоятельной работы с языковым материалом с использованием справочной и учебной литературы

		УК-5.2 Учитывает при социальном и профессиональном общении историческое наследие и социокультурные традиции различных социальных групп, этносов и конфессий, включая мировые религии, философские и этические учения УК-5.2/Зн1 основные этапы истории России и Всеобщей истории; основные факторы социально-исторического развития, определяющие межкультурное разнообразие общества; типы и виды исторических источников, подходы к анализу и интерпретации исторических источников; требования и подходы сравнительно-исторического анализа УК-5.2/Ум1 грамотно и доступно излагать информацию в процессе профессионального взаимодействия; соблюдать этические нормы межкультурного взаимодействия; анализировать и реализовывать социальное взаимодействие с учётом национальных, этнокультурных, конфессиональных особенностей оппонентов. УК-5.2/Нв1 навыками сравнительно-исторического анализа социально-исторических явлений; приёмами описания межкультурного разнообразия общества, обусловленного социально-историческими причинами и факторами. УК-4.3 Ведет деловую коммуникацию в письменной и электронной форме, учитывая особенности стилистики официальных и неофициальных писем, социокультурные различия в формате корреспонденции на государственном и иностранном (-ых) языках УК-4.3/Зн1 нормы произношения, лексику иностранного языка общеупотребительного, терминологического и профессионального содержания; типовые способы построения высказываний в устной и письменной речи УК-4.3/Ум1 осуществляет коммуникацию с зарубежными партнерами; переводит научно-техническую литературу, связанную с профессиональной деятельностью УК-4.3/Нв1 стратегиями проведения сопоставительного анализа факторов культуры различных стран УК-5.3 Придерживается принципов недискриминационного взаимодействия при личном и массовом общении в целях выполнения профессиональных задач и усиления социальной интеграции УК-5.3/Зн1 этапы исторического развития России в контексте мировой истории, социокультурные традиции мира, основные философские, религиозные и этические учения. УК-5.3/Ум1 организовывать продуктивное взаимодействие в профессиональной среде с учётом национальных, этнокультурных, конфессиональных особенностей. УК-5.3/Нв1 навыками общения с людьми. УК-4.4 Представляет свою точку зрения при деловом общении и в публичных выступлениях УК-4.4/Зн1 лексический минимум в объеме 2000 лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессиональго содержания из зарубежных источников УК-4.4/Ум1 осуществлять коммуникацию с зарубежными партнерами; переводить научно-техническую литературу по вопросами, связанным с профессиональной деятельностью УК-4.4/Нв1 компенсаторными умениями, помогающими преодолеть "сбои" в коммуникации, вызванные объективными и субъективными, социокультурными причинами

	УК-5.4 Применяет основные категории исторической науки и философского мировоззрения к анализу специфики различных культурных сообществ УК-5.4/Зн1 этапы исторического развития общества (включая основные события, деятельность основных исторических деятелей) и культурные традиции мира (включая мировые религии, философские и этические учения). УК-5.4/Ум1 толерантно и конструктивно взаимодействовать с людьми с учётом их социокультурных особенностей в целях успешного выполнения профессиональных задач и усиления социальной интеграции. УК-5.4/Нв1 выбор способа поведения в поликультурном коллективе при конфликтной ситуации.
Хорошо	УК-4.1 Выбирает стиль общения на государственном языке РФ и иностранном языке в зависимости от цели и условий партнерства; адаптирует речь, стиль общения и язык жестов к ситуациям взаимодействия УК-4.1/Зн1 Лексический минимум в объеме 2000 учебных лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессионального содержания из зарубежных источников УК-4.1/Ум1 Выполнять переводы технических текстов с иностранного языка УК-4.2 Выполняет перевод профессиональных текстов с иностранного языка на государственный язык РФ и с государственного языка РФ на иностранный УК-4.2/Зн1 Основные способы работы на языковым и речевым материалом УК-4.2/Ум1 Выполнять перевод технических текстов с иностранного языка УК-5.2 Учитывает при социальном и профессиональном общении историческое наследие и социокультурные традиции различных социальных групп, этносов и конфессий, включая мировые религии, философские и этические учения УК-5.2/Зн1 основные этапы истории России и Всеобщей истории; основные факторы социально-исторического развития, определяющие межкультурное разнообразие общества; типы и виды исторических источников, подходы к анализу и интерпретации исторических источников; требования и подходы сравнительно-исторического анализа УК-5.2/Ум1 грамотно и доступно излагать информацию в процессе профессионального взаимодействия; соблюдать этические нормы межкультурного взаимодействия; анализировать и реализовывать социальное взаимодействие с учётом национальных, этнокультурных, конфессиональных особенностей оппонентов. УК-4.3 Ведет деловую коммуникацию в письменной и электронной форме, учитывая особенности стилистики официальных и неофициальных писем, социокультурные различия в формате корреспонденции на государственном и иностранном (-ых) языках УК-4.3/Зн1 нормы произношения, лексику иностранного языка общеупотребительного, терминологического и профессионального содержания; типовые способы построения высказываний в устной и письменной речи УК-4.3/Ум1 осуществляет коммуникацию с зарубежными партнерами; переводит научно-техническую литературу, связанную с профессиональной деятельностью

	УК-5.3 Придерживается принципов недискриминационного взаимодействия при личном и массовом общении в целях выполнения профессиональных задач и усиления социальной интеграции УК-5.3/Зн1 этапы исторического развития России в контексте мировой истории, социокультурные традиции мира, основные философские, религиозные и этические учения. УК-5.3/Ум1 организовывать продуктивное взаимодействие в профессиональной среде с учётом национальных, этнокультурных, конфессиональных особенностей. УК-4.4 Представляет свою точку зрения при деловом общении и в публичных выступлениях УК-4.4/Зн1 лексический минимум в объеме 2000 лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессиональго содержания из зарубежных источников УК-4.4/Ум1 осуществлять коммуникацию с зарубежными партнерами; переводить научно-техническую литературу по вопросами, связанным с профессиональной деятельностью УК-5.4 Применяет основные категории исторической науки и философского мировоззрения к анализу специфики различных культурных сообществ УК-5.4/Зн1 этапы исторического развития общества (включая основные события, деятельность основных исторических деятелей) и культурные традиции мира (включая мировые религии, философские и этические учения). УК-5.4/Ум1 толерантно и конструктивно взаимодействовать с людьми с учётом их социокультурных особенностей в целях успешного выполнения профессиональных задач и усиления социальной интеграции.
Удовлетворительно	УК-4.1 Выбирает стиль общения на государственном языке РФ и иностранном языке в зависимости от цели и условий партнерства; адаптирует речь, стиль общения и язык жестов к ситуациям взаимодействия УК-4.1/Зн1 Лексический минимум в объеме 2000 учебных лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессионального содержания из зарубежных источников УК-4.2 Выполняет перевод профессиональных текстов с иностранного языка на государственный язык РФ и с государственного языка РФ на иностранный УК-4.2/Зн1 Основные способы работы на языковым и речевым материалом УК-5.2 Учитывает при социальном и профессиональном общении историческое наследие и социокультурные традиции различных социальных групп, этносов и конфессий, включая мировые религии, философские и этические учения УК-5.2/Зн1 основные этапы истории России и Всеобщей истории; основные факторы социально-исторического развития, определяющие межкультурное разнообразие общества; типы и виды исторических источников, подходы к анализу и интерпретации исторических источников; требования и подходы сравнительно-исторического анализа

	УК-4.3 Ведет деловую коммуникацию в письменной и электронной форме, учитывая особенности стилистики официальных и неофициальных писем, социокультурные различия в формате корреспонденции на государственном и иностранном (-ых) языках УК-4.3/Зн1 нормы произношения, лексику иностранного языка общеупотребительного, терминологического и профессионального содержания; типовые способы построения высказываний в устной и письменной речи УК-5.3 Придерживается принципов недискриминационного взаимодействия при личном и массовом общении в целях выполнения профессиональных задач и усиления социальной интеграции УК-5.3/Зн1 этапы исторического развития России в контексте мировой истории, социокультурные традиции мира, основные философские, религиозные и этические учения. УК-4.4 Представляет свою точку зрения при деловом общении и в публичных выступлениях УК-4.4/Зн1 лексический минимум в объеме 2000 лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессиональго содержания из зарубежных источников УК-5.4 Применяет основные категории исторической науки и философского мировоззрения к анализу специфики различных культурных сообществ УК-5.4/Зн1 этапы исторического развития общества (включая основные события, деятельность основных исторических деятелей) и культурные традиции мира (включая мировые религии, философские и этические учения).
Неудовле-творительно	Результаты обучения не сформированы на достаточном уровне
Оценка	Критерии оценивания (перечень сформированных ИДК/ЗУВ)
Зачтено	УК-4.1 Выбирает стиль общения на государственном языке РФ и иностранном языке в зависимости от цели и условий партнерства; адаптирует речь, стиль общения и язык жестов к ситуациям взаимодействия УК-4.1/Зн1 Лексический минимум в объеме 2000 учебных лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессионального содержания из зарубежных источников УК-4.2 Выполняет перевод профессиональных текстов с иностранного языка на государственный язык РФ и с государственного языка РФ на иностранный УК-4.2/Зн1 Основные способы работы на языковым и речевым материалом УК-5.2 Учитывает при социальном и профессиональном общении историческое наследие и социокультурные традиции различных социальных групп, этносов и конфессий, включая мировые религии, философские и этические учения УК-5.2/Зн1 основные этапы истории России и Всеобщей истории; основные факторы социально-исторического развития, определяющие межкультурное разнообразие общества; типы и виды исторических источников, подходы к анализу и интерпретации исторических источников; требования и подходы сравнительно-исторического анализа

	УК-4.3 Ведет деловую коммуникацию в письменной и электронной форме, учитывая особенности стилистики официальных и неофициальных писем, социокультурные различия в формате корреспонденции на государственном и иностранном (-ых) языках УК-4.3/Зн1 нормы произношения, лексику иностранного языка общеупотребительного, терминологического и профессионального содержания; типовые способы построения высказываний в устной и письменной речи УК-5.3 Придерживается принципов недискриминационного взаимодействия при личном и массовом общении в целях выполнения профессиональных задач и усиления социальной интеграции УК-5.3/Зн1 этапы исторического развития России в контексте мировой истории, социокультурные традиции мира, основные философские, религиозные и этические учения. УК-4.4 Представляет свою точку зрения при деловом общении и в публичных выступлениях УК-4.4/Зн1 лексический минимум в объеме 2000 лексических единиц общего и терминологического характера, необходимого для возможности получения информации профессиональго содержания из зарубежных источников УК-5.4 Применяет основные категории исторической науки и философского мировоззрения к анализу специфики различных культурных сообществ УК-5.4/Зн1 этапы исторического развития общества (включая основные события, деятельность основных исторических деятелей) и культурные традиции мира (включая мировые религии, философские и этические учения).
Не зачтено	Результаты обучения не сформированы на достаточном уровне

4. Контрольные мероприятия по дисциплине

Вид контроля	Форма контроля/Оценочное средство
Текущий контроль	Контрольная работа
Промежуточная аттестация	Зачет Экзамен

№ п/п	Наименование раздела	Контролируемые ИДК	Вид контроля/ используемые оценочные материалы	
			Текущий	Промежут. аттестация
1	Вводно-коррективный курс	УК-4.1		Зачет Экзамен
2	Общий курс иностранного языка	УК-4.1 УК-4.4 УК-5.1 УК-5.3	Контрольная работа	Зачет Экзамен
3	Профессионально-ориентированный иностранный язык	УК-4.1 УК-4.2 УК-4.3 УК-4.4 УК-5.1 УК-5.2 УК-5.3 УК-5.4	Контрольная работа	Зачет Экзамен

5. Порядок проведения промежуточной аттестации

Порядок проведения промежуточной аттестации регламентируется локальными нормативными актами Университета:
- Положением о формах, периодичности, порядке текущего контроля успеваемости и промежуточной аттестации обучающихся по основным образовательным программам высшего образования – программам бакалавриата, программам специалитета, программам магистратуры в федеральном государственном бюджетном образовательном учреждении высшего образования «Московский государственный университет геодезии и картографии», п.6 «Организация и проведение промежуточной аттестации».
- Положением о порядке осуществления образовательного процесса, проведения текущего контроля успеваемости и промежуточной аттестации обучающихся с применением электронного обучения и дистанционных образовательных технологий в федеральном государственном бюджетном образовательном учреждении высшего образования «Московский государственный университет геодезии и картографии», п.8 «Проведение промежуточной аттестации с применением ЭО и ДОТ».

Промежуточная аттестация: Зачет, 2 семестр.

Промежуточная аттестация: Экзамен, 3 семестр.

6. Оценочные материалы текущего контроля

Раздел 2. Общий курс иностранного языка
Контролируемые ИДК: УК-4.1 УК-4.4 УК-5.1 УК-5.3

Тема 2.5. Россия в современном мире, Москва, мой родной город.
Форма контроля/оценочное средство: Контрольная работа
Вопросы/Задания:
1. Answer the question:
What does the science of history of architecture study?
1. Architecture development process in connection with the biological processes
2. The relationship between people and animals
3. Architecture development process in connection with the historical processes
2. Choose the correct expression:
The detailed study of a site is
1. site analysis
2. bird analysis
3. cat analysis
3. Complete the sentence using the correct word:

_____ is your address?
1. What
2. How
3. That
4. Do you speak Japanese? No, I _____.
1. speaking not
2. speak not
3. don’t
5. Pick up the correct word:
a person or company, responsible for the physical construction of a building is _____
1. scientist

2. constructor
3. doctor

6. What do we call:
a thin tall structure usually rising above the castle or building that it is attached to?
1. tower
2. table
3. tree

7. When was the University of .Geodesy and Cartograpy founded?
1. 1779
2. 1920
3. 2000

8. What do modal verbs show?
1. modality
2. time
3. voice

9. Choose the correct sentence:
1. I am a student.
2. A student I am.
3. A student am I.

10. Раскройте скобки, употребляя глаголы в требующемся времени.
When I (to come) to Pete's house last Sunday, he (to read) a new book

11. Раскройте скобки, употребляя глаголы в требующемся времени.
Yesterday I (to buy) a new pair of gloves, as I (to lose) the old ones.

12. Раскройте скобки, употребляя глаголы в требующемся времени.
I (to meet) him when he (to walk) across the park.

13. Раскройте скобки, употребляя глаголы в требующемся времени.
Don't enter the bedroom! The child (to sleep) there, and he always (to wake) up when somebody (to open) the door.

14. Раскройте скобки, употребляя глаголы в требующемся времени.
What the children (to do) now? — Oh, they (to play) the new table game which I (to buy) for them the day before yesterday.

15. Раскройте скобки, употребляя глаголы в требующемся времени.
We could not go out because it (to rain) hard since early morning.

16. Раскройте скобки, употребляя глаголы в требующемся времени.
When I (to come) home yesterday, my sister already (to return) and (to sit) at the fireplace looking through some old photographs.

17. Раскройте скобки, употребляя глаголы в требующемся времени.
When morning came, the storm already (to stop), but the snow still (to fall).

18. Раскройте скобки, употребляя глаголы в требующемся времени.
I (to hear) this song several times already, but I cannot remember the words.

19. Передайте следующие предложения в Passive Voice.
I bought potatoes yesterday.

20. Передайте следующие предложения в Passive Voice.
We will bring the books tomorrow.

21. Передайте следующие предложения в Passive Voice.
They are repairing the clock now.

22. Передайте следующие предложения в Passive Voice.
I have translated the whole text.

23. Передайте следующие предложения в Passive Voice.
They broke the window last week

24. Передайте следующие предложения в Passive Voice.
They were playing tennis from four till five.

25. Передайте следующие предложения в Passive Voice.
By six o'clock they had finished the work.

26. Передайте следующие предложения в Passive Voice.
They are building a new concert-hall in our street.

27. Передайте следующие предложения в Passive Voice.
Livingstone explored Central Africa in the 19th century.

28. Передайте следующие предложения в Passive Voice.
They haven't brought back my skates.

29. Передайте предложения в косвенную речь.
“My friend lives in Moscow”, said Alec.

30. Передайте предложения в косвенную речь.
“I can’t explain this rule to you”’ said my classmate to me.

31. Передайте предложения в косвенную речь.
He said:” I have just received a letter from my uncle”

32. Передайте предложения в косвенную речь.
She asked me: ”What will you do tomorrow?”

33. Передайте предложения в косвенную речь.
She asked me:”Why did you come here yesterday?”

34. Передайте предложения в косвенную речь.
I asked me uncle: ”How long did you stay in Moscow?”

35. Передайте предложения в косвенную речь.
The teacher said to me:”Does your father work at a factory?”

36. Передайте предложения в косвенную речь.
“Did you go shopping yesterday?”, said grandmother to Mary

37. Передайте предложения в косвенную речь.
Father said to Nick:”Have you done your homework?”

38. Передайте предложения в косвенную речь.
“Tom, go to bed”, said his mother.

39. Передайте предложения в косвенную речь.
Kate said to her grandmother:”Help me to cook the soup, please”.

40. Передайте предложения в косвенную речь.
“Don’t play in the street”, said the van to the boys.

41. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
the party / Linda / to / come / might / tonight.

42. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
round / work / have to / farmers / the year / all.

43. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
you / not / hospital / noise / must / make / in.

44. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
the light / I / switch / may / on ?

45. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
your / look / could / passport / I / at ?

46. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
catch / last / able to / we / were / train / the.

47. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
didn't / you / drink / have to / much / yesterday / so.

48. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
ought to / bill / Robert / the electricity / pay / today.

49. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
better / we / find / a / should / job.

50. Составьте предложения с модальными глаголами, расставив слова в нужном порядке. Переведите получившиеся предложения.
too much / you / salt / and / eat / sugar / shouldn't.

Раздел 3. Профессионально-ориентированный иностранный язык
Контролируемые ИДК: УК-4.1 УК-4.2 УК-4.3 УК-4.4 УК-5.1 УК-5.2 УК-5.3 УК-5.4

Тема 3.2. Моя специальность: История изучаемой науки и видные ученые
Форма контроля/оценочное средство: Контрольная работа
Вопросы/Задания:

1. Translate the text

To understand the properties of modern optoelectronic devices, as well as a number of other devices in the real world, it is imperial to discuss first of all the PN junction diode - the fundamental building block of the modern electronic age. A silicon atom consists of fourteen negatively-charged electrons surrounding a central nucleus - the charge of the nucleus makes the atom neutral. A lattice of silicon atoms is known as an Intrinsic semiconductor, and consists of a single silicon atom bonded to four neighboring atoms covalently. This means that holes, or a lack of an electron in an atoms band, in the valence band are vacancies created by electrons that have been thermally excited to the conduction band. This thermal excitation can arise when energy has been applied to the atom in the form of heat energy, or light of a specific wavelength. A single atom of boron, as well as a single atom of arsenic, has not net electric charge. Boron and arsenic appear on the periodic table to the left and right of silicon respectively. This means the number of electrons in the valence band are lower and higher respectively. In the process of "doping," atoms of boron, for example, can be added to the silicon crystal to decrease the total amount of electrons present. The same process can be applied to a silicon lattice with an atom of arsenic; in this case, the arsenic increase the number of electrons in the semi-conductor. This electron is now free to move around the crystal, with much less energy applied than in the case of the normal silicon lattice. In the case of both dopant, there is now a charge associated; with excess holes, the semiconductor becomes p-type. With excess electrons, the semiconductor becomes n-type. Both semiconductors are extrinsic. The amount of doping can be increased or decreased, depending on the situation.

7. Оценочные материалы промежуточной аттестации

2 семестр, Зачет
Контролируемые ИДК: УК-4.1 УК-5.1 УК-4.2 УК-5.2 УК-4.3 УК-5.3 УК-4.4 УК-5.4
Вопросы/Задания:

1. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The flag of the UK is known as the Union Jack. It has its history. It all began in 1603 when Scotland

was joined to England and Wales. The flag is made up of 3 crosses. The upright cross is the Cross of St. Jeorge the patron saint of England. The white diagonal cross is the cross of St. Andrew, the patron saint of Scotland. The red diagonal cross is the cross is the cross of St. Patrick, the patron saint of Ireland. All of them are on the blue background. The national anthem is . The national currency is pound. Geographically the island of Great Britain is subdivided into 2 main regions: Lowland Britain and Highland Britain. Lowland Britain comprises southern and eastern England. Highland Britain consists of Scotland, most of Wales, the Pennines (or the Pennine Chain) and the Lake District. The highest mountain top is Ben Nevis in Scotland. The chief rivers of Great Britain are: the Severn, separating England and Wales, the Thames (the longest and the deepest one). The swiftest flowing river is the Spray. Also the Tweed is famous (the woolen fabric is made here). Every country in the UK has its own national emblem. The red rose is the national emblem of England, the thistle is the national emblem of Scotland, the daffodils and the leek are the emblems of Wales, and the shamrock (a kind of clover) is the emblem of Ireland.

2. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The United Kingdom is a constitutional monarchy. It has a monarch - a King or a Queen. The present British monarch is Queen Elizabeth the Second. She become Queen in 1952. The monarch has little power and can reign with the support of Parliament. British Parliament is the legislative body at the country. It consists of two Houses. The House of Commons and House of Lords. Parliament and the monarch have different roles in the Government of the country. In reality, the House of Commons has truth power. It introduces new bills. Then they go to the House of Lords for approval. The functions of the Queen are: to open the sessions of the Parliament, to head the commonwealth, to be Commander-in-Chief, to declare the war, to make peace. The house of commons is made up of 650 elected knows of members of parliament. The party which has the majority of suits in the Government and its leader usually becomes prime minister. The prime minister forms his or her Cabinet Ministers. The chairman of the House of Commons is the Speaker. The chairman of the House of Lords is the Lord Chancellor. He sits on a special place, which is called the woolsack. It means that wool made England rich. The members of the House of Lords are not elected, there are live peers. There are several political parties in Great Britain. They are the Conservative, the Liberal, the Labor, the Social Democratic and the Communist parties. Prime minister of the country Boris Johnson is leader of the Conservative Party.

3. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

Siberia, in the north of Russia, is one of the coldest, harshest places on earth. Famed for its inhospitable climate, it is also mineral-wealthy and unexploited – a true frontier region. Although it has attracted mining companies for decades, the challenging landscape and conditions have meant they have only just begun to scratch the surface of the area's potential.

This could now be changing; as climate change leads to warmer temperatures, ice and permafrost are melting and potentially easing the mining process. The mining sector is the second biggest contributor to GDP in Russia, and is expected to continue to play an important role in its economy.

Mining in Siberia grew exponentially during the 20th century, as successive governments and leaders sought to take advantage of it. "The Siberian region is rich in minerals including coal, gold, diamond and iron ore," says Globaldata analyst Alok Shukla. "Coal is largely extracted from Kemerovo, Krasnoyarsk Krai, Sakha (Yakutia), Republic of Khakassia, and Irkutsk Oblast. Gold originates mainly from Krasnoyarsk Krai and Irkutsk Oblast."

Russia is responsible for 7% of global aluminium production, and 95% of this takes place in Siberia. It is home to Russia's largest coal mine, the Arshanovsky pit in the Khakassia Republic which opened in 2015. When at full capacity it is expected to produce 10 million tonnes of coal, and there are already plans to expand it further. Siberia and the Far East also hold 84% of Russia's known gold reserves.

But much remains unexplored or inaccessible in Siberia still, leaving the true mineral wealth of the region uncertain. In 2016, a mineral was discovered in Siberia unlike any ever found naturally occurring on earth. Instead it appears to be similar to lab-grown metal-organic frameworks. Such discoveries highlight the potential of a region so long hidden under ice and thick forests.

4. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

In recent years, climate change has been a much talked about issue, with many debates over its possible impact on the world, and some even going so far as to question its very existence. However, with the undeniable increase in greenhouse emissions on Earth, there can be no doubt that the earth is becoming warmer.

So what exactly does this mean for the future of our planet? In chilly places like the UK, we may think to ourselves: 'Finally, warmer weather!' But global warming will in fact cause extreme weather conditions, meaning that our winters would be even colder than they are now. More than that, warmer temperatures will lead to the melting of ice in the north and south poles, which in turn will lead to rising sea levels across the globe. This is particularly troubling for low coastal regions such as Florida in the USA which would be among the first to be flooded, along with many islands around the world, including the United Kingdom. In 1000 years or so, all these places and more will be submerged underwater.

So where will be able to live? Unless we can find a way to evolve into mermaids and mermen, which doesn't look promising, the only solution is to move elsewhere. There will be little choice left once a large proportion of the land is lost to the sea, and other remaining places will be so hot that they will be absolutely impossible to survive in. It is possible, then, that the once frozen poles of the Arctic and Antarctica will be suitable enough to live in, having melted its ice and warmed up.

It's a scary thought to imagine such devastation on Earth. Perhaps if people start to realize how their actions now can have such a profound impact on future generations, they will change their attitude and start to think more about caring for the environment, in order to save it.

5. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

Inland Weather in Wales

The higher you get in Wales, the colder and wetter it gets. And as you move away from the coasts, Wales is quilted with river valleys separated by increasingly higher hills. The Brecon Beacons in south Wales, are softly rolling but enormous, windswept hills where winter temperatures below freezing and snowfalls are not uncommon. Further north, in the inland mountains of Snowdonia National Park, heavy precipitation can be extreme. One mountain peak, Crib Goch, may be the wettest place in the entire country with an astonishing 176 inches of rainfall annually.2 And on the highest peaks, it snows a great deal.

Mount Snowdon, at 3,560 feet and the highest U.K. mountain south of Scotland, can experience snowfall from October to May.

Snowfall at lower altitudes is rare, with an average of only 10 days a year with snow lying on the ground in the south and west Wales. On the other hand, the mountains of Snowdonia average 30 days a year with snowfall lying on the ground.

Autumn and Winter in Wales

In September, temperatures linger in the 60s but fall away rapidly through October and November into the high 40s. January and February are the coldest months with temperatures hovering around freezing or slightly above in higher areas and in the high 40s along the coast. Temperatures at night are usually 10 to as much as 15 degrees Fahrenheit colder depending on where you are in the country.

October through January are the wettest months. Rain tends to fall in short, sharp and very heavy showers. November is particularly squally with rain accompanied by gusty winds.

6. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

Scotland is a country in the north of Great Britain. It is a part of the United Kingdom. Scotland is divided into three natural regions: the Southern Uplands, the Central Lowlands and the Highlands and islands. A lot of places in Scotland are a natural paradise, still untouched by man.

The capital of Scotland is Edinburgh, well known for its castle. Glasgow is the industrial capital of Scotland. It is the third largest city in Great Britain. The typical products of Scotland are timber, whisky, salmon. Golf is the Scottish natural sport and it seems to have originated in this country.

Scotland is also the land of myths and mysteries; every castle has its ghost. Glamis Castle is said to

have nine of them. And of course everyone knows about the Loch Ness Monster. 'Nessie" is said to be about six meters long, with a long, thin neck. The first report of the monster in Loch Ness was in 565 A.D. Since 1934, thousands of people claimed to they had seen the monster. Scientists have investigated the Loch and taken pictures but no scientific explanation of the mystery has been given. Scotland is the north part of Great Britain. Five million people live in Scotland. Edinburgh is the capital of Scotland.

7. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The London Eye, or the Millennium Wheel, is a cantilevered observation wheel on the South Bank of the River Thames in London. It is Europe's tallest cantilevered observation wheel, and is the most popular paid tourist attraction in the United Kingdom with over 3 million visitors annually. It has made many appearances in popular culture.

The structure is 135 metres (443 ft) tall and the wheel has a diameter of 120 metres (394 ft). When it opened to the public in 2000 it was the world's tallest Ferris wheel. Its height was surpassed by the 167 metres (548 ft) High Roller (Las Vegas) in 2014. Supported by an A-frame on one side only, unlike the taller Nanchang and Singapore wheels, the Eye is described by its operators as "the world's tallest cantilevered observation wheel".

The London Eye used to offer the highest public viewing point in London until it was superseded by the 245-metre-high (804 ft) observation deck on the 72nd floor of The Shard, which opened to the public on 1 February 2013.

In March 2020, the London Eye celebrated its 20th birthday by turning several of its pods into experiences themed around London, in partnership with its sponsor lastminute.com. The special experiences included a pub in a capsule, a west end theatre pod and a garden party with flower arrangements to represent the eight London Royal parks.

8. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The Shard, located in London, is one of the most iconic skyscrapers in the United Kingdom and a prominent feature of the city’s skyline. Completed in 2012, it was designed by the renowned architect Renzo Piano and stands at a height of 310 meters (1,016 feet), making it the tallest building in the UK and the fifth tallest in Europe. The Shard's unique design resembles a shard of glass, with its tapering form and reflective façade that changes appearance with the weather and time of day.

The construction of The Shard began in 2009 and was part of a larger redevelopment project for London Bridge Station and its surrounding area. The building consists of 95 floors, with a mix of office space, restaurants, a hotel, and residential apartments. The top floors house an observation deck known as "The View from The Shard," which offers breathtaking panoramic views of London and beyond, attracting millions of visitors each year.

One of the most notable features of The Shard is its innovative use of glass. The façade is made up of 11,000 glass panels that create a shimmering effect, allowing natural light to flood the interior spaces while providing stunning views for those inside. The building is also designed with sustainability in mind; it incorporates energy-efficient systems and has achieved a BREEAM rating for its environmental performance.

The Shard has become a symbol of modern London and is often featured in films, television shows, and promotional materials for the city. Its presence has also spurred further development in the surrounding area, contributing to London's status as a global financial hub.

In addition to its architectural significance, The Shard has played host to various cultural events and exhibitions since its opening. It has become a popular venue for corporate events, weddings, and private functions due to its stunning views and luxurious amenities.

Overall, The Shard represents not only an architectural achievement but also a testament to London's ongoing evolution as a vibrant metropolis. Its striking design and multifunctional use make it an essential part of the city's landscape and an enduring attraction for both locals and tourists alike.

9. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

As one of the world’s leading cities, London is at the forefront of addressing climate change and environmental sustainability. The Greater London Authority (GLA) has set an ambitious target to

achieve net-zero carbon emissions by 2030. This goal reflects a commitment to creating a cleaner, healthier, and more sustainable urban environment for current and future generations.

Understanding the Zero Carbon Target

The zero carbon target means that London aims to balance the amount of greenhouse gases emitted with the amount removed from the atmosphere. This involves reducing emissions across various sectors, including transportation, buildings, energy production, and waste management. The target is not just about reducing carbon footprints but also about fostering resilience against climate impacts.

To achieve its zero carbon goal, London is implementing strategies across several key areas:

Energy Efficiency in Buildings: A significant portion of London's emissions comes from buildings. The GLA is promoting retrofitting existing structures to improve energy efficiency and encouraging new developments to meet stringent sustainability standards. Initiatives include the London Plan, which mandates higher energy performance standards for new buildings.

Renewable Energy Transition: Increasing the use of renewable energy sources is crucial for reducing carbon emissions. London aims to expand solar energy installations, wind power projects, and other renewable technologies. The city is also exploring community energy schemes that empower residents to generate and share renewable energy.

Sustainable Transport: Transportation is another major contributor to London's carbon footprint. The city is investing in public transport infrastructure, expanding cycling networks, and promoting electric vehicles (EVs). Initiatives like the Ultra Low Emission Zone (ULEZ) aim to reduce air pollution and encourage cleaner modes of transport.

Waste Management: Reducing waste and increasing recycling rates are essential components of London's sustainability strategy. The city is working towards a circular economy model that minimizes waste generation and maximizes resource recovery through recycling and composting programs.

Innovation and Technology

London recognizes that innovation plays a critical role in reaching its zero carbon goal. The city is investing in smart technologies that enhance energy efficiency and reduce emissions. This includes smart grids for better energy management, data analytics for optimizing transport systems, and digital platforms that facilitate sustainable practices among residents.

London's zero carbon target represents a bold vision for a sustainable future—a future where economic growth does not come at the expense of environmental health. By prioritizing energy efficiency, renewable energy adoption, sustainable transport solutions, waste reduction strategies, community engagement, and technological innovation, London aims to lead by example in the global fight against climate change. Achieving this ambitious goal will not only benefit the environment but also enhance the quality of life for all Londoners by creating a cleaner, greener city for generations to come.

10. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The climate of the United Kingdom is characterized by its temperate maritime conditions, which result in relatively mild temperatures, moderate rainfall, and a lack of extreme weather events compared to many other regions. However, the UK is not immune to the impacts of climate change, which pose significant challenges to its environment, economy, and society. Understanding the current climate dynamics and the implications of climate change is crucial for developing effective strategies for mitigation and adaptation.

The UK experiences four distinct seasons, with average temperatures ranging from about 1°C (34°F) in winter to 20°C (68°F) in summer. Rainfall is distributed fairly evenly throughout the year, with some regions, particularly in the west and north, receiving significantly more precipitation than others. The climate varies across the country:

Southern England: Generally warmer and drier, with milder winters.

Northern England and Scotland: Cooler temperatures and higher rainfall.

Coastal Areas: Influenced by maritime conditions, leading to milder winters but also increased vulnerability to storms and flooding.

The effects of climate change are becoming increasingly evident in the UK:

Rising Temperatures: Average temperatures have increased by approximately 1°C since the late 19th

century. This trend is expected to continue, leading to hotter summers and milder winters.
Increased Rainfall and Flooding: While overall rainfall may not significantly increase, extreme weather events are becoming more frequent. Heavy rainfall can lead to flooding, particularly in urban areas with inadequate drainage systems.
Sea Level Rise: Coastal areas are at risk due to rising sea levels caused by melting ice caps and thermal expansion of seawater. This threatens communities, infrastructure, and ecosystems along the coast.
Biodiversity Loss: Changing climates can disrupt ecosystems and habitats, leading to shifts in species distribution and increased risks for native wildlife.
Climate Adaptation Strategies: The government is developing strategies to adapt to climate impacts through improved infrastructure resilience, flood defenses, and sustainable land management practices.
Investment in Renewable Energy: The UK has made significant strides in transitioning to renewable energy sources such as wind (both onshore and offshore), solar power, and biomass. This shift aims to reduce reliance on fossil fuels and lower carbon emissions.
Local communities play a vital role in addressing climate change. Initiatives such as community-led renewable energy projects, tree planting campaigns, and local sustainability programs empower residents to take action at a grassroots level. Public awareness campaigns also aim to educate citizens about their carbon footprints and encourage sustainable practices.
The UK's climate presents both challenges due to the impacts of climate change and opportunities for innovation towards a sustainable future. By committing to ambitious targets like net-zero emissions, investing in renewable energy sources, engaging communities in sustainability efforts, and adapting infrastructure for resilience against extreme weather events, the UK aims not only to mitigate its own environmental impact but also to serve as a global leader in addressing one of humanity's most pressing issues—climate change. As these efforts continue to evolve, they will shape the future landscape of both the environment and society across the nation.

11. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The population of the United Kingdom (UK) is a dynamic and diverse entity, reflecting a rich tapestry of cultures, ethnicities, and histories. As of 2023, the estimated population stands at approximately 67 million people, making the UK one of the most populous countries in Europe. Understanding the demographic trends and characteristics of the UK population is essential for addressing social, economic, and political challenges.
The UK is characterized by its multicultural society. The population includes a wide range of ethnic groups, with White British being the largest demographic, followed by significant communities of South Asian, Black, Mixed, and other ethnic backgrounds. Major cities like London, Birmingham, Manchester, and Leicester are particularly known for their cultural diversity. London alone is home to over 300 languages spoken by its residents.
The UK has experienced fluctuating population growth rates over the years. Following a period of steady growth in the early 21st century, recent trends indicate a slowdown in growth due to various factors such as declining birth rates and changes in immigration patterns. The fertility rate in the UK has fallen below the replacement level of 2.1 children per woman, leading to concerns about an aging population.
One of the most significant demographic challenges facing the UK is its aging population. Advances in healthcare and living standards have contributed to increased life expectancy, which currently averages around 81 years. As a result, the proportion of older adults (aged 65 and over) is rising rapidly. This shift presents challenges for healthcare services, pensions, and social care systems as they adapt to meet the needs of an older demographic.
Migration has played a crucial role in shaping the UK’s population dynamics. Historically a destination for immigrants seeking better opportunities, recent years have seen changes in migration patterns due to political events such as Brexit and global crises like the COVID-19 pandemic. While net migration has fluctuated, it remains a vital component of population growth and contributes to workforce diversity.
The population of the United Kingdom is characterized by its diversity and complexity. As it navigates challenges such as an aging demographic and changing migration patterns, understanding

these dynamics will be crucial for shaping effective policies that promote social cohesion and economic stability. By embracing its multicultural identity while addressing regional disparities and demographic shifts, the UK can work towards a future that benefits all its residents.

12. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The economy of the United Kingdom (UK) is one of the largest and most developed in the world, characterized by a diverse range of industries, a strong services sector, and a significant global presence. As of 2023, the UK economy is recovering from the impacts of the COVID-19 pandemic and navigating challenges such as inflation, supply chain disruptions, and geopolitical uncertainties.

The UK economy is primarily service-oriented, with services accounting for approximately 80% of GDP. Key sectors include finance, healthcare, education, retail, and tourism. London serves as a global financial hub, hosting numerous banks, investment firms, and insurance companies. The City of London and Canary Wharf are central to this financial activity, attracting international investment and talent.

Manufacturing remains an important part of the economy, contributing around 10% to GDP. The UK has a strong manufacturing base in industries such as aerospace, automotive, pharmaceuticals, and food production. Despite facing challenges from globalization and competition, British manufacturers continue to innovate and adapt to changing market demands.

The UK is a significant player in international trade. It exports goods and services worth hundreds of billions annually, with major trading partners including the European Union (EU), the United States, China, and Japan. Key exports include machinery, vehicles, pharmaceuticals, and financial services.

Post-Brexit trade dynamics have shifted as the UK navigates new trade agreements outside the EU framework. The government has sought to establish free trade agreements with various countries to enhance market access for British businesses.

Despite its strengths, the UK economy faces several challenges:

Inflation: Rising inflation rates have impacted consumer purchasing power and business costs. The Bank of England has responded with monetary policy adjustments to stabilize prices.

Supply Chain Disruptions: Global supply chain issues have affected various sectors, leading to delays in production and increased costs for businesses.

Geopolitical Uncertainties: Ongoing geopolitical tensions can influence trade relationships and economic stability.

The economy of the United Kingdom is marked by its resilience and adaptability in the face of challenges. With a strong services sector at its core and ongoing efforts towards innovation and sustainability, the UK continues to play a vital role in the global economic landscape. As it navigates post-pandemic recovery while addressing inflationary pressures and labor market dynamics, strategic policies will be essential for fostering growth that benefits all segments of society.

13. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

London, the capital city of England and the United Kingdom, boasts a rich and diverse history that spans over two millennia. Its origins can be traced back to the Roman period when it was established as Londinium around AD 43. The Romans recognized the strategic importance of the River Thames for trade and transportation, leading to the rapid growth of the settlement. By the end of the first century, Londinium had developed into a bustling town with a population of around 60,000, complete with a forum, basilica, and defensive walls.

Following the decline of Roman rule in the early 5th century, London experienced a period of instability and fragmentation. The Anglo-Saxons began to settle in the area, and by the 9th century, it had become an important trading hub known as Lundenwic. However, this prosperity was threatened by Viking invasions, leading to the establishment of fortified settlements.

The Norman Conquest in 1066 marked a significant turning point in London's history. William the Conqueror built the Tower of London as a symbol of power and control over the city. The subsequent centuries saw London grow in importance as a political and economic center. The establishment of institutions such as Parliament and the Church further solidified its status.

The medieval period was marked by significant events such as the Black Death in 1348, which

decimated London's population but also led to social and economic changes. The city continued to expand during the Tudor period, becoming a cultural hub under monarchs like Henry VIII and Elizabeth I.

The Great Fire of London in 1666 was another pivotal moment that reshaped the city. It destroyed much of medieval London but also provided an opportunity for reconstruction. Sir Christopher Wren played a crucial role in redesigning St. Paul's Cathedral and other buildings that defined London's skyline.

The Industrial Revolution in the 18th and 19th centuries transformed London into one of the world's largest cities. It became a center for finance, trade, and industry, attracting millions from rural areas and abroad. This rapid urbanization brought challenges such as overcrowding and pollution but also led to advancements in infrastructure, including railways and public transport.

The 20th century saw London endure two World Wars, which caused significant destruction but also fostered resilience among its inhabitants. Post-war reconstruction efforts led to modernization while preserving historical landmarks.

Today, London is a vibrant global city known for its cultural diversity, economic significance, and historical heritage. From its Roman roots to its status as a modern metropolis, London's history is a testament to its ability to adapt and thrive through centuries of change.

14. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

Moscow, the capital city of Russia, has a rich and complex history that dates back to its founding in the 12th century. The city was first mentioned in historical records in 1147 when Prince Yuri Dolgoruky invited other princes to a feast. Initially, Moscow was a small settlement on the banks of the Moskva River, but its strategic location made it an important center for trade and politics.

In the late 13th century, Moscow began to rise in prominence under the leadership of Prince Ivan I, also known as Ivan Kalita. He managed to consolidate power and expand the territory, establishing Moscow as a significant principality. The city became the center of the Russian Orthodox Church after the fall of Kiev to the Mongols in 1240, further enhancing its influence.

The Mongol invasion in the 13th century led to several decades of domination known as the "Tatar Yoke." Despite this oppression, Moscow gradually gained strength and autonomy. By the late 15th century, under Grand Prince Ivan III (Ivan the Great), Moscow successfully overthrew Mongol rule and expanded its territory significantly. Ivan III also initiated major construction projects, including the Kremlin's stone walls and towers, which still stand today.

The 16th century saw the rise of Ivan IV (Ivan the Terrible), who was crowned as Russia's first tsar in 1547. His reign marked both expansion and turmoil; while he expanded Russian territory into Siberia, his later years were characterized by paranoia and violence, leading to a period of instability after his death in 1584.

The Time of Troubles (1598-1613) followed, marked by political chaos and foreign intervention. This period ended with the establishment of the Romanov dynasty in 1613, which would rule Russia for over three centuries. Under Peter the Great in the late 17th and early 18th centuries, Moscow faced competition from St. Petersburg as a political center but remained culturally significant.

The 19th century brought significant changes with industrialization and social upheaval. The Decembrist revolt in 1825 highlighted growing discontent among Russian elites. The city also played a crucial role during events such as Napoleon's invasion in 1812 when much of Moscow was burned to prevent French forces from using it.

The early 20th century was marked by revolutionary fervor. The Bolshevik Revolution in 1917 led to significant political changes; Moscow became the capital of Soviet Russia and later the Soviet Union. Under communist rule, extensive urban development transformed Moscow into a symbol of Soviet power.

After World War II, Moscow emerged as a global superpower's capital during the Cold War era. The city continued to grow economically and culturally despite facing challenges such as political repression.

With the dissolution of the Soviet Union in 1991, Moscow underwent significant transformations as Russia transitioned towards a market economy. Today, it stands as a vibrant metropolis known for its rich history, diverse culture, and economic significance on both national and global stages.

15. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

Three Famous Places in London

London, a city steeped in history and culture, is home to numerous iconic landmarks. Among them, the Tower of London, Buckingham Palace, and the British Museum stand out as must-visit destinations that reflect the city's rich heritage.

1. The Tower of London

The Tower of London, a UNESCO World Heritage Site, is one of the most famous historical landmarks in the city. Founded by William the Conqueror in 1066, this imposing fortress has served various roles throughout its history, including royal palace, prison, and treasury. The Tower is perhaps best known for housing the Crown Jewels, a stunning collection of royal regalia that includes crowns, scepters, and other ceremonial items. Visitors can explore its medieval architecture, learn about its storied past through guided tours led by the Yeoman Warders (commonly known as Beefeaters), and hear tales of intrigue and imprisonment associated with figures like Anne Boleyn and Sir Thomas More.

2. Buckingham Palace

Buckingham Palace serves as the official residence of the British monarch and is an enduring symbol of the British monarchy. Originally built in 1703 as a townhouse for the Duke of Buckingham, it became a royal residence in 1837 when Queen Victoria ascended to the throne. The palace features 775 rooms and is surrounded by beautiful gardens. One of its most popular attractions is the Changing of the Guard ceremony, which takes place daily during summer and every other day during winter. Visitors can also tour the State Rooms during certain months when they are open to the public, offering a glimpse into royal life and opulence.

3. The British Museum

The British Museum is one of the world's oldest and most comprehensive museums dedicated to human history and culture. Established in 1753, it houses an extensive collection of over eight million works from various civilizations across the globe. Highlights include the Rosetta Stone, which was key to deciphering Egyptian hieroglyphs; the Elgin Marbles from the Parthenon; and mummies from ancient Egypt. The museum's architecture is equally impressive, featuring a stunning glass-roofed Great Court that provides a modern contrast to its historic galleries. Admission to the museum is free, making it accessible to millions who come to explore its vast array of artifacts.

16. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The Center of London: A Vibrant Hub of Culture and History

The center of London is a bustling metropolis that serves as the heart of the United Kingdom's capital. This area is not only a financial powerhouse but also a cultural epicenter, rich in history and diversity. Spanning several boroughs, including Westminster and the City of London, the central area is home to iconic landmarks, world-class museums, and vibrant neighborhoods.

One of the most recognizable features of central London is its historic architecture. The Houses of Parliament, with the iconic Big Ben (now known as the Elizabeth Tower), stands majestically along the River Thames. This Gothic Revival masterpiece is not only a symbol of British democracy but also a UNESCO World Heritage Site. Nearby, Westminster Abbey has been the site of royal ceremonies for centuries, including coronations and weddings, making it a significant religious and historical landmark.

Just a short walk away lies Trafalgar Square, a lively public space that commemorates Admiral Nelson's victory at the Battle of Trafalgar. The square is adorned with the impressive Nelson's Column and is surrounded by notable institutions such as the National Gallery, which houses an extensive collection of European paintings. This area often hosts events and gatherings, making it a focal point for both locals and tourists.

Shopping enthusiasts flock to Oxford Street, one of Europe's busiest shopping streets, featuring over 300 shops ranging from high-street brands to luxury boutiques. Nearby Regent Street offers a more upscale shopping experience with its elegant architecture and flagship stores. For those seeking a more eclectic vibe, Covent Garden provides a mix of shops, street performances, and dining options in a charming setting.

Cultural experiences abound in central London. The West End is renowned for its theaters showcasing world-class productions ranging from classic plays to contemporary musicals. Visitors can enjoy everything from Shakespearean dramas to modern hits like "The Lion King" or "Hamilton." The area's vibrant nightlife also includes an array of pubs, bars, and restaurants offering diverse cuisines from around the globe.

Central London is well-connected by an extensive public transport system that includes buses and the iconic London Underground (the Tube). This accessibility makes it easy for visitors to explore various neighborhoods such as Soho, known for its lively atmosphere and nightlife; Chinatown, with its authentic Asian cuisine; and Southbank, which offers stunning views along the Thames River.

In addition to its historical significance and cultural offerings, central London is also home to green spaces like Hyde Park and St. James's Park. These parks provide a tranquil escape from the urban hustle and bustle where visitors can relax or enjoy outdoor activities.

In summary, the center of London is a dynamic blend of history, culture, shopping, and entertainment. Its iconic landmarks tell stories of Britain's past while contemporary attractions reflect its vibrant present. Whether you're exploring historic sites or indulging in modern experiences, central London offers something for everyone—a true testament to its status as one of the world's great cities.

17. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The center of Moscow is a vibrant and bustling area that serves as the heart of Russia's capital. Known for its rich history, stunning architecture, and cultural significance, this part of the city attracts millions of visitors each year. The blend of historical landmarks and modern developments creates a unique atmosphere that reflects both the past and the present.

At the core of Moscow lies the iconic Red Square, one of the most famous squares in the world. This UNESCO World Heritage Site is surrounded by remarkable structures, including the colorful St. Basil's Cathedral with its distinctive onion domes, which has become a symbol of Russia itself. The square also features the imposing walls of the Kremlin, a fortified complex that serves as the official residence of the President of Russia. The Kremlin is home to several palaces and cathedrals, showcasing stunning examples of Russian architecture and art.

Adjacent to Red Square is Lenin's Mausoleum, where visitors can pay their respects to the founder of the Soviet Union. The mausoleum stands as a reminder of Russia's tumultuous history and its impact on contemporary society. Nearby, GUM (Glavny Universalny Magazin), a historic department store with an elegant glass roof, offers a luxurious shopping experience with high-end boutiques and cafes.

Moscow's central area is also known for its impressive metro system, often referred to as one of the most beautiful in the world. Many metro stations are adorned with intricate mosaics, chandeliers, and sculptures that reflect Soviet-era art and design. Stations like Komsomolskaya and Mayakovskaya are particularly noteworthy for their stunning aesthetics.

Cultural experiences abound in central Moscow. The Bolshoi Theatre is renowned for its ballet and opera performances, attracting art lovers from around the globe. Just a short walk away lies Tverskaya Street, one of Moscow's main thoroughfares lined with shops, restaurants, and theaters. This bustling street epitomizes modern Moscow while still retaining elements of its historical charm.

For those seeking green spaces amidst the urban landscape, Gorky Park offers a refreshing escape. This expansive park features walking paths, open-air cafes, and recreational activities such as cycling and rollerblading. It serves as a popular gathering place for locals and tourists alike.

The center of Moscow is also home to numerous museums that showcase Russian art and history. The State Tretyakov Gallery houses an extensive collection of Russian fine art from various periods, while the Pushkin State Museum of Fine Arts features works from European masters.

As night falls, central Moscow transforms into a lively hub filled with nightlife options ranging from trendy bars to traditional Russian restaurants offering local cuisine. The illuminated skyline adds to the city's charm as visitors enjoy evening strolls along the Moskva River or through historic streets.

18. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The Moscow Kremlin is one of the most iconic landmarks in Russia and serves as a powerful symbol of the nation's history and political authority. Located in the heart of Moscow, this fortified complex

has been the center of Russian power for centuries, housing the offices of the President of Russia and serving as a UNESCO World Heritage Site.

The Kremlin's history dates back to the 12th century when it was established as a wooden fort. Over the years, it evolved into a grand stone fortress, with its walls and towers constructed from red brick in the late 15th century under the direction of Italian architects. The Kremlin's imposing walls stretch for over two kilometers and are punctuated by 20 towers, each with its own unique design and historical significance. The most famous of these is the Spasskaya Tower, adorned with a clock that chimes on the hour and serves as a symbol of Moscow itself.

Within the Kremlin's walls lies a treasure trove of architectural marvels and historical sites. The Cathedral Square is at its heart, surrounded by three magnificent cathedrals: the Assumption Cathedral, where Russian tsars were crowned; the Archangel Cathedral, which houses the tombs of many Russian princes; and the Annunciation Cathedral, known for its stunning frescoes. These cathedrals showcase exquisite examples of Russian Orthodox architecture and art.

Another significant structure within the Kremlin is the Grand Kremlin Palace, which was built in the 19th century as a residence for Russian tsars. Today, it serves as an official residence for the President and hosts important state ceremonies. The palace features opulent interiors adorned with lavish decorations that reflect Russia's imperial past.

The State Armory Museum (Оружейная Палата) is another highlight within the Kremlin complex. It houses an impressive collection of royal artifacts, including crowns, thrones, ceremonial weapons, and carriages used by Russian monarchs. Visitors can explore exhibits that showcase Russia's rich cultural heritage and craftsmanship.

The Kremlin is not only a historical site but also an active political center. It has witnessed significant events throughout Russian history, from grand coronations to pivotal political decisions. Today, it remains a symbol of national pride and authority.

Surrounding the Kremlin are beautiful gardens and parks that offer stunning views of this historic site. The Alexander Garden features well-maintained pathways, fountains, and monuments commemorating key figures in Russian history. Visitors can stroll through these green spaces while enjoying picturesque views of the Kremlin's towers.

Access to the Kremlin is available to tourists who wish to explore its rich history firsthand. Guided tours provide insights into its architectural wonders and historical significance while allowing visitors to appreciate its beauty up close.

19. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The Tower of London, one of the most famous landmarks in England, has a rich and complex history that spans over 1,000 years. Founded by William the Conqueror in 1066 as part of the Norman Conquest, the Tower was originally built to assert his power over the newly acquired territory. The White Tower, its central structure, is an impressive example of Norman military architecture and served as a royal palace and fortress.

Throughout its history, the Tower has played various roles: it has been a royal residence, a treasury, an armory, and even a menagerie. Its strategic location on the banks of the River Thames made it an essential defensive stronghold for London. The Tower's walls have witnessed numerous significant events, including royal ceremonies and political intrigue.

One of the most notorious aspects of the Tower's history is its use as a prison. Over the centuries, it has housed many high-profile prisoners, including Anne Boleyn, Thomas More, and Lady Jane Grey. The executions that took place within its walls have contributed to its dark reputation. Anne Boleyn was famously executed on Tower Green in 1536; her ghost is said to haunt the grounds to this day.

The Tudor period marked a significant transformation for the Tower. Under King Henry VIII, it became a symbol of royal power and authority. The infamous Beefeaters (Yeoman Warders) were established during this time to guard the Tower and its prisoners. Today, they serve as tour guides and custodians of its rich history.

In addition to its role as a prison, the Tower has also been a place of great ceremony. It is home to the Crown Jewels of England, which include some of the most magnificent regalia in the world. These treasures are displayed in a secure exhibition within the Tower and attract millions of visitors each year.

The 17th century saw further changes as the Tower's military significance diminished. It became

more associated with ceremonial functions than with defense. However, it remained an important symbol of monarchy and national identity.
In 1840, Queen Victoria designated the Tower as a historical monument rather than an active fortress or prison. This shift marked the beginning of its transformation into a major tourist attraction. Restoration efforts were undertaken to preserve its structures and artifacts for future generations.
Today, the Tower of London is recognized as a UNESCO World Heritage Site and remains one of London's most visited attractions. Visitors come from around the globe to explore its storied past through guided tours that reveal tales of intrigue, betrayal, and royal grandeur.
The annual Ceremony of the Keys continues to be performed each night at precisely 9:53 PM—a tradition that dates back centuries—symbolizing that all gates are locked for security.

20. Выполните полный письменный перевод со словарем текста с английского языка на русский (1000-1200 п.зн. за 45 мин.)

The British Museum: A Chronicle of Human History

The British Museum, located in the heart of London, is one of the world's most renowned cultural institutions, dedicated to human history, art, and culture. Established in 1753, it was founded on the collections of Sir Hans Sloane, a physician and naturalist who bequeathed his vast array of artifacts to the nation. The museum opened its doors to the public in 1759, making it one of the first public museums in the world.
From its inception, the British Museum aimed to make knowledge accessible to all. Its founding principle was to collect and preserve objects that represented the diversity of human experience. The museum's original collection included around 71,000 items, ranging from antiquities to natural specimens. Over time, this collection has expanded exponentially and now encompasses over eight million objects.
The museum's architecture is as impressive as its collections. The original building was designed by Sir Robert Smirke in a neoclassical style and features the iconic Great Court (Большой Двор), which was completed in 2000. The Great Court houses the stunning glass-roofed Reading Room and serves as a central hub for visitors.
One of the most significant aspects of the British Museum is its vast collection of artifacts from ancient civilizations. Among its most famous exhibits are the Rosetta Stone, which played a crucial role in deciphering Egyptian hieroglyphs; the Elgin Marbles from the Parthenon in Athens; and an extensive collection of Egyptian mummies. These items not only showcase artistic achievement but also provide invaluable insights into ancient cultures.

Throughout its history, the museum has been at the center of debates regarding cultural heritage and repatriation. Many artifacts were acquired during periods of colonial expansion, leading to ongoing discussions about their rightful ownership. The museum has faced criticism for holding items that some argue should be returned to their countries of origin. In response, it has engaged in dialogue with various nations regarding cultural restitution while emphasizing its role in preserving global heritage.
The British Museum has also played a significant role in education and research. It offers numerous programs for schools and communities, aiming to foster understanding and appreciation for world cultures. Scholars from around the globe utilize its extensive library and archives for research purposes.
In addition to its permanent collections, the museum hosts temporary exhibitions that explore specific themes or cultures in greater depth. These exhibitions often draw on loans from other institutions or private collections, further enriching visitors' experiences.
Today, the British Museum attracts millions of visitors each year from all corners of the globe. It remains free to enter (though some special exhibitions may charge), reflecting its commitment to accessibility and public engagement with history and culture.

21. Просмотрите текст и ответьте на вопрос: Why do we call Russia the largest county in the world?

Located in the north, west and east latitudes of the Northern Hemisphere, most of Russia is much closer to the North Pole than to the equator. Individual country comparisons are of little value in

gauging Russia's enormous size and diversity. The country's 17.1 million square kilometers include one-eighth of the Earth's inhabited land area. Its European portion, which occupies a substantial part of continental Europe, is home to most of Russia's industrial and agricultural activity and is where, roughly between the Dnieper River and the Ural Mountains, the Russian Empire took shape. Russia includes the entire northern portion of Asia.

From west to east, the country stretches from Kaliningrad to Ratmanov Island in the Bering Strait. This distance is roughly equivalent to the distance from Glasgow, Scotland, to Nome, Alaska. From north to south, the country ranges from the northern tip of the Russian Arctic islands at Franz Josef Land to the southern tip of the Republic of Dagestan on the Caspian Sea, spanning about 4,500 kilometres of extremely varied, often inhospitable terrain.

Extending for 57,792 kilometres, the Russian border is the world's longest.

22. Просмотрите текст и ответьте на вопрос: Why are there no skyscrapers in Washington, D.C?

One can hardly find a park, a square or an open area in Washington without a monument or a memorial. The most impressive and the best-known ones are the Lincoln Memorial and the Washington Monument. There are some important museums in Washington where you can see all kinds of things: famous paintings and sculptures, the dresses of President's wives, the original of the Declaration of Independence, the largest blue diamond in the world, etc. There are 5 universities in Washington.

There are no skyscrapers in Washington, because they would hide the city's many monuments from view. No building in the city may be more than 40 meters tall. Thousands of tourists visit Washington every day. People from all parts of the United States come to see then- capital.

The Jefferson Memorial was built in memory of the third President of the USA, Thomas Jefferson, who was also the author of the Declaration of Independence. The memorial is surrounded by cherry-trees. The Lincoln Memorial devoted to the memory of the 16th President of the US, the author of the Emancipation Proclamation, which gave freedom to Negro slaves in America.

23. Просмотрите текст и ответьте на вопрос: What factors contribute to the air pollution problem?

Air pollution and climate change.

Problem: Overloading of the atmosphere and of ocean waters with carbon. Atmospheric CO2 absorbs and re-emits infrared-wavelength radiation, leading to warmer air, soils, and ocean surface waters - which is good: The planet would be frozen solid without this.

Unfortunately, there's now too much carbon in the air. Burning of fossil fuels, deforestation for agriculture, and industrial activities have pushed up atmospheric CO2 concentrations from 280 parts per million (ppm) 200 years ago, to about 400 ppm today. That's an unprecedented rise, in both size and speed. The result: climate disruption.

Carbon overloading is only one form of air pollution caused by burning coal, oil, gas and wood. The World Health Organization recently estimated that one in nine deaths in 2012 were attributable to diseases caused by carcinogens and other poisons in polluted air.

Solutions: Replace fossil fuels with renewable energy. Reforestation. Reduce emissions from agriculture. Change industrial processes.

The good news is that clean energy is abundant - it just needs to be harvested. Many say a 100 percent renewable-energy future is feasible with existing technology now.

But the bad news is that even though renewable energy infrastructure - solar panels, wind turbines, energy storage and distribution systems - are already widespread, and getting cheaper and more efficient all the time, experts say we're not applying them quickly enough to prevent catastrophic climate disruption. Barriers in policy and finance remain to be overcome.

24. Просмотрите текст и ответьте на вопрос: What factors contribute to the pollution problem?

WE MUST PROTECT OUR ENVIRONMENT

Our country. Our environment. There are many big and small rivers, green forests, high mountains, lakes and seas in Russia. Our Earth is our home. I think people must take care of our Motherland. But the problem of pollution now is very important. There are some factors that increase the

problem.
First of all, our plants and factories put their waste materials into water and atmosphere and pollute the environment. There are many kinds of transport in our cities. We can't ignore their effect on the environment, that is why we must pay attention to the protection of our nature and the health of the people.
Radiation. Now it has become one of the main problems. It is not good for health of people. Many people died from radiation some years ago in Chernobol. It was a tragedy. The other problem is an earthquake. We know some terrible earthquakes in Chile, Haiti, Japan. Our scientists try to forecast earthquakes, then we can protect ourselves from them.

25. Просмотрите текст и ответьте на вопрос: What are key features of the green economy?

KEY FEATURES OF THE GREEN ECONOMY
Simply put, a green economy is low-carbon, resource efficient, and socially inclusive. Some of it's key features include:
Abundant opportunities for good green jobs that pay a living wage.
A price on carbon, either through a cap-and-trade program or an economy-wide tax on carbon.
More efficient use of energy and other resources. For example, huge economic and environmental gains could be made if we had more energy efficient buildings and transportation.
Greater use of renewable resources, like wind and solar, instead of non-renewable resources, such as coal and oil.
Greener manufacturing which is resource efficient and doesn't use toxic chemicals
Proper value assigned to natural environments and ecosystems, in recognition of all the services the environment provides such as carbon sequestration, flood protection, and waste water treatment.
A robust recycling and reuse industry, with minimal waste sent to landfill.

26. Просмотрите текст и ответьте на вопрос: Why is it important to plant and restore forests?

Deforestation.
Problem: Species-rich wild forests are being destroyed, especially in the tropics, often to make way for cattle ranching, soybean or palm oil plantations, or other agricultural monocultures.
Today, about 30 percent of the planet's land area is covered by forests - which is about half as much as before agriculture got started around 11,000 years ago. About 7.3 million hectares (18 million acres) of forest are destroyed each year, mostly in the tropics. Tropical forests used to cover about 15 percent of the planet's land area; they're now down to 6 or 7 percent. Much of this remainder has been degraded by logging or burning.
Not only do natural forests act as biodiversity reserves, they are also carbon sinks, keeping carbon out of the atmosphere and oceans.
Solutions: Conserve of what's left of natural forests, and restore degraded areas by replanting with native tree species. This requires strong governance - but many tropical countries are still developing, with increasing populations, uneven rule-of-law, and widespread cronyism and bribery when it comes to allocating land use.

27. Просмотрите текст и ответьте на вопрос: What is green economy?

WHAT IS THE GREEN ECONOMY?
Today, many people realize that it's not about the environment versus the economy, not a tradeoff between unemployment and pollution. It's not about picking one or the other.
We cannot choose between the environment and the economy. We need both.
This realization is at the heart of an emerging economic and environmental concept, often termed " the green economy."
It reflects a growing recognition that, on the one hand, the challenge of sustainability rests almost entirely in getting the economy right. Putting a price on carbon, valuing natural capital and ending perverse subsidies, among other things, are all vital to meaningful environmental reform.
And, on the other hand, if we wish to create a sustainable economy, we must pay more attention to the environment. Against a backdrop of climate change, resource scarcity, the massive loss of biodiversity and a variety of other environmental issues, business as usual is increasingly risky.
The green economy was initially driven by an environmental imperative, the recognition that climate

change and ecological degradation threaten our future prosperity. But today, it is driven equally by opportunity, the recognition that a green economy opens up new possibilities for jobs and growth. As a recent report from the U.N. put it, “the greening of economies is not generally a drag on growth but rather a new engine of growth…a net generator of decent jobs…”

28. Просмотрите текст и ответьте на вопрос: “What are the pivotal moments in the history of medieval London?

London, the capital city of England and the United Kingdom, boasts a rich and diverse history that spans over two millennia. Its origins can be traced back to the Roman period when it was established as Londinium around AD 43. The Romans recognized the strategic importance of the River Thames for trade and transportation, leading to the rapid growth of the settlement. By the end of the first century, Londinium had developed into a bustling town with a population of around 60,000, complete with a forum, basilica, and defensive walls.

Following the decline of Roman rule in the early 5th century, London experienced a period of instability and fragmentation. The Anglo-Saxons began to settle in the area, and by the 9th century, it had become an important trading hub known as Lundenwic. However, this prosperity was threatened by Viking invasions, leading to the establishment of fortified settlements.

The Norman Conquest in 1066 marked a significant turning point in London's history. William the Conqueror built the Tower of London as a symbol of power and control over the city. The subsequent centuries saw London grow in importance as a political and economic center. The establishment of institutions such as Parliament and the Church further solidified its status.

The medieval period was marked by significant events such as the Black Death in 1348, which decimated London's population but also led to social and economic changes. The city continued to expand during the Tudor period, becoming a cultural hub under monarchs like Henry VIII and Elizabeth I.

The Great Fire of London in 1666 was another pivotal moment that reshaped the city. It destroyed much of medieval London but also provided an opportunity for reconstruction. Sir Christopher Wren played a crucial role in redesigning St. Paul's Cathedral and other buildings that defined London's skyline.

The Industrial Revolution in the 18th and 19th centuries transformed London into one of the world's largest cities. It became a center for finance, trade, and industry, attracting millions from rural areas and abroad. This rapid urbanization brought challenges such as overcrowding and pollution but also led to advancements in infrastructure, including railways and public transport.

The 20th century saw London endure two World Wars, which caused significant destruction but also fostered resilience among its inhabitants. Post-war reconstruction efforts led to modernization while preserving historical landmarks.

Today, London is a vibrant global city known for its cultural diversity, economic significance, and historical heritage. From its Roman roots to its status as a modern metropolis, London's history is a testament to its ability to adapt and thrive through centuries of change.

29. Просмотрите текст и ответьте на вопрос: What time does London’s origin trace back?

London's origins trace back to a strategic decision by Roman invaders in 43 AD, when Emperor Claudius established Londinium as a key military and trading settlement. This foundational period shaped the city's enduring character through several critical developments:

Roman Establishment (43-60 AD)

- Founded as a river port at the narrowest Thames crossing point
- Initial settlement covered 1.4 km² (modern City of London area)
- Strategic location connected roads to major Roman British towns

Boudican Revolt & Rebuilding (60-120 AD)

- Destroyed in 60 AD by Iceni tribe led by Queen Boudica (королева Боадицея), a queen of the ancient British Iceni tribe (племя иценов), who led a failed uprising against the conquering forces of the Roman Empire in AD 60 or 61.
- Reconstructed with improved stone defenses and grid-pattern streets
- Built first London Bridge (wooden, near modern bridge location)

Peak Roman Development (2nd-4th Century)

- Became provincial capital of Britannia by 100 AD
- Constructed major infrastructure:
  - Basilica (largest north of Alps)
  - Amphitheater (discovered under Guildhall)
  - 3 km defensive wall (sections still visible)
- Reached population of 30,000-45,000

Key Foundations for Future Growth

- Established as England's first international trade hub
- Created enduring street patterns still visible today
- Built original Thames embankments
- Developed as administrative center (traits continuing today)

Decline and Transition (5th Century)

- Roman withdrawal around 410 AD led to urban decline
- Settlement continued at reduced scale (Saxon Lundenwic)
- Original walls maintained through Middle Ages

The Roman foundation established London's lasting advantages: strategic location, commercial orientation, and administrative importance - qualities that would eventually propel it to global prominence.

30. Просмотрите текст и ответьте на вопрос: “What are the key economic changes London has undergone in the 21st Century (2000–Present) “

London’s Transformation in the 21st Century (2000–Present)

Since 2000, London has undergone dramatic changes, solidifying its status as a global city while facing new challenges. From urban regeneration to economic shifts, the capital has evolved in response to globalization, technological advances, and socio-political changes.

1. Urban Regeneration & Architecture

- The Shard (Шард – название небоскреба ввиде «осколка» (2012): Europe’s tallest skyscraper (310m), symbolizing modern London.
- Olympic Legacy (2012): Stratford’s transformation with Queen Elizabeth Olympic Park and new neighborhoods.
- Crossrail (Elizabeth Line, 2022): Europe’s largest infrastructure project, improving east-west transit.

2. Economic Shifts

- Tech Boom: Rise of "Silicon Roundabout" (Old Street) as a rival to California’s tech hubs.
- Brexit Impact: Financial sector adjustments, though London remains Europe’s top financial center.
- Green Economy: Growth in renewable energy startups and low-emission policies (ULEZ expansion).

3. Cultural & Demographic Changes

- Population Growth: From 7.2 million (2000) to nearly 9 million today.
- Super-Diversity: Over 300 languages spoken; 45% of residents foreign-born.
- Cultural Landmarks: Tate Modern extension (2016), V&A East (2025).

4. Challenges

- Housing Crisis: Soaring prices push residents farther out; "Generation Rent" struggles.
- Climate Resilience: Flood risks (Thames Barrier upgrades) and urban heat island effect.
- Social Inequality: Wealth gaps widen despite economic growth.

The Future of London

31. Просмотрите текст и ответьте на вопрос: “ Why are smart homes and low-power devices considered to be key solutions for sustainable living? “

Smart Homes and Low-Power Devices: Green Technology for Sustainable Living

As energy demands rise and environmental concerns grow, smart homes and low-power devices are emerging as key solutions for sustainable living. By integrating energy-efficient technologies with automation, modern households can significantly reduce electricity consumption, minimize waste, and lower carbon footprints.

Smart homes use IoT (Internet of Things) devices to optimize energy usage by:

- Automated lighting systems (e.g., motion sensors, smart bulbs like Philips Hue) that turn off when not needed.
- Smart thermostats (e.g., Nest, Ecobee) that learn user habits and adjust heating/cooling to save energy.
- Energy monitoring systems that track real-time electricity usage and suggest optimizations.

Low-Power Devices: Reducing Energy Waste

Advances in semiconductor technology have led to ultra-efficient electronics:

- Low-power processors (e.g., ARM Cortex-M for IoT) that extend battery life in smart sensors.
- Energy Star-certified appliances (refrigerators, washing machines) that consume 10–50% less power.
- Solar-powered smart gadgets (e.g., smart blinds, outdoor cameras) that rely on renewable energy.

Green Technology in Smart Homes

1. Energy Storage & Renewable Integration
   - Home battery systems (e.g., Tesla Powerwall) store solar energy for nighttime use.
   - Smart inverters optimize solar panel output, feeding excess power back to the grid.
2. AI-Driven Energy Management
   - AI algorithms predict usage patterns and shift high-power tasks (e.g., EV charging) to off-peak hours.
3. E-Waste Reduction
   - Modular smart devices (e.g., Framework Laptop) allow easy upgrades, reducing electronic waste.
   - Companies like Apple use recycled materials in products like HomePod.

Smart homes and low-power devices exemplify how green technology can merge sustainability with convenience. By adopting these solutions, households can cut energy bills, reduce reliance on fossil fuels, and contribute to a zero-waste future.

32. Просмотрите текст и ответьте на вопрос: “ How does the Gulf Stream work”

The Gulf Stream's Vital Role in Europe's Climate

The Gulf Stream is a powerful Atlantic Ocean current that transports warm water from the Gulf of Mexico to Northwestern Europe. This "heat conveyor belt" is responsible for Europe's unusually mild climate given its high latitudes, making winters in London warmer than those in Newfoundland at the same latitude.

How the Gulf Stream Works

1. Current Mechanics:
   - Begins in the Gulf of Mexico (water heated to 30°C)
   - Flows northeast at 2-5 mph (100x Amazon River volume)
   - Cools near Greenland, sinks, and returns south (AMOC circulation)
2. Heat Transfer:
   - Releases heat equivalent to 1.5 million nuclear power plants
   - Raises European temperatures by 5-10°C in winter

Europe's Climate Dependence

Temperature Regulation:

- UK/Ireland: 10°C warmer than same-latitude Canada
- Norway: Coastal ports remain ice-free year-round
- France: Enables wine-growing at 48°N (parallel to Canada's cold Newfoundland)

Precipitation Patterns:

- Brings moisture for Western Europe's rainfall
- Supports agriculture from Ireland to Ukraine

Climate Change Threats

1. AMOC Weakening:
   - 15% slowdown since 1950 (IPCC data)
   - Melting Greenland ice dilutes salty water, disrupting sinking mechanism
2. Potential Collapse:
   - Could lower European temperatures by 3-5°C
   - May increase storms and shift rain belts southward

Economic and Ecological Impacts

1. Agriculture:

- UK growing seasons could shorten by 30 days
- Mediterranean drought intensification

2. Energy:
   - Increased winter heating demands
   - Reduced hydropower in Scandinavia
3. Ecosystems:
   - North Sea fisheries disruption
   - Boreal forest migration

Monitoring and Solutions

33. Просмотрите текст и ответьте на вопрос: “What is the history of the Union Jack“

The flag of the UK is known as the Union Jack. It has its history. It all began in 1603 when Scotland was joined to England and Wales. The flag is made up of 3 crosses. The upright cross is the Cross of St. Jeorge the patron saint of England. The white diagonal cross is the cross of St. Andrew, the patron saint of Scotland. The red diagonal cross is the cross is the cross of St. Patrick, the patron saint of Ireland. All of them are on the blue background. The national anthem is . The national currency is pound. Geographically the island of Great Britain is subdivided into 2 main regions: Lowland Britain and Highland Britain. Lowland Britain comprises southern and eastern England. Highland Britain consists of Scotland, most of Wales, the Pennines (or the Pennine Chain) and the Lake District. The highest mountain top is Ben Nevis in Scotland. The chief rivers of Great Britain are: the Severn, separating England and Wales, the Thames (the longest and the deepest one). The swiftest flowing river is the Spray. Also the Tweed is famous (the woolen fabric is made here). Every country in the UK has its own national emblem. The red rose is the national emblem of England, the thistle is the national emblem of Scotland, the daffodils and the leek are the emblems of Wales, and the shamrock (a kind of clover) is the emblem of Ireland.

34. Просмотрите текст и ответьте на вопрос: “ What are the functions of the monarch in the United Kingdom? “

The United Kingdom is a constitutional monarchy. It has a monarch - a King or a Queen. The present British monarch is Queen Elizabeth the Second. She become Queen in 1952. The monarch has little power and can reign with the support of Parliament. British Parliament is the legislative body at the country. It consists of two Houses. The House of Commons and House of Lords. Parliament and the monarch have different roles in the Government of the country. In reality, the House of Commons has truth power. It introduces new bills. Then they go to the House of Lords for approval. The functions of the Queen are: to open the sessions of the Parliament, to head the commonwealth, to be Commander-in-Chief, to declare the war, to make peace. The house of commons is made up of 650 elected knows of members of parliament. The party which has the majority of suits in the Government and its leader usually becomes prime minister. The prime minister forms his or her Cabinet Ministers. The chairman of the House of Commons is the Speaker. The chairman of the House of Lords is the Lord Chancellor. He sits on a special place, which is called the woolsack. It means that wool made England rich. The members of the House of Lords are not elected, there are live peers. There are several political parties in Great Britain. They are the Conservative, the Liberal, the Labor, the Social Democratic and the Communist parties. Prime minister of the country Boris Johnson is leader of the Conservative Party.

35. Просмотрите текст и ответьте на вопрос: “ What natural resources is the Siberian region rich in?”

Siberia, in the north of Russia, is one of the coldest, harshest places on earth. Famed for its inhospitable climate, it is also mineral-wealthy and unexploited – a true frontier region. Although it has attracted mining companies for decades, the challenging landscape and conditions have meant they have only just begun to scratch the surface of the area’s potential.

This could now be changing; as climate change leads to warmer temperatures, ice and permafrost are melting and potentially easing the mining process. The mining sector is the second biggest contributor to GDP in Russia, and is expected to continue to play an important role in its economy.

Mining in Siberia grew exponentially during the 20th century, as successive governments and leaders sought to take advantage of it. “The Siberian region is rich in minerals including coal, gold, diamond

and iron ore," says Globaldata analyst Alok Shukla. "Coal is largely extracted from Kemerovo, Krasnoyarsk Krai, Sakha (Yakutia), Republic of Khakassia, and Irkutsk Oblast. Gold originates mainly from Krasnoyarsk Krai and Irkutsk Oblast."

Russia is responsible for 7% of global aluminium production, and 95% of this takes place in Siberia. It is home to Russia's largest coal mine, the Arshanovsky pit in the Khakassia Republic which opened in 2015. When at full capacity it is expected to produce 10 million tonnes of coal, and there are already plans to expand it further. Siberia and the Far East also hold 84% of Russia's known gold reserves.

But much remains unexplored or inaccessible in Siberia still, leaving the true mineral wealth of the region uncertain. In 2016, a mineral was discovered in Siberia unlike any ever found naturally occurring on earth. Instead it appears to be similar to lab-grown metal-organic frameworks. Such discoveries highlight the potential of a region so long hidden under ice and thick forests.

36. Просмотрите текст и ответьте на вопрос: "What are the consequences of global warming"

In recent years, climate change has been a much talked about issue, with many debates over its possible impact on the world, and some even going so far as to question its very existence. However, with the undeniable increase in greenhouse emissions on Earth, there can be no doubt that the earth is becoming warmer.

So what exactly does this mean for the future of our planet? In chilly places like the UK, we may think to ourselves: 'Finally, warmer weather!' But global warming will in fact cause extreme weather conditions, meaning that our winters would be even colder than they are now. More than that, warmer temperatures will lead to the melting of ice in the north and south poles, which in turn will lead to rising sea levels across the globe. This is particularly troubling for low coastal regions such as Florida in the USA which would be among the first to be flooded, along with many islands around the world, including the United Kingdom. In 1000 years or so, all these places and more will be submerged underwater.

So where will be able to live? Unless we can find a way to evolve into mermaids and mermen, which doesn't look promising, the only solution is to move elsewhere. There will be little choice left once a large proportion of the land is lost to the sea, and other remaining places will be so hot that they will be absolutely impossible to survive in. It is possible, then, that the once frozen poles of the Arctic and Antarctica will be suitable enough to live in, having melted its ice and warmed up.

It's a scary thought to imagine such devastation on Earth. Perhaps if people start to realize how their actions now can have such a profound impact on future generations, they will change their attitude and start to think more about caring for the environment, in order to save it.

37. Просмотрите текст и ответьте на вопрос: "What is the weather like in Wales in autumn and winter?"

Inland Weather in Wales

The higher you get in Wales, the colder and wetter it gets. And as you move away from the coasts, Wales is quilted with river valleys separated by increasingly higher hills. The Brecon Beacons in south Wales, are softly rolling but enormous, windswept hills where winter temperatures below freezing and snowfalls are not uncommon. Further north, in the inland mountains of Snowdonia National Park, heavy precipitation can be extreme. One mountain peak, Crib Goch, may be the wettest place in the entire country with an astonishing 176 inches of rainfall annually.2 And on the highest peaks, it snows a great deal.

Mount Snowdon, at 3,560 feet and the highest U.K. mountain south of Scotland, can experience snowfall from October to May.

Snowfall at lower altitudes is rare, with an average of only 10 days a year with snow lying on the ground in the south and west Wales. On the other hand, the mountains of Snowdonia average 30 days a year with snowfall lying on the ground.

Autumn and Winter in Wales

In September, temperatures linger in the 60s but fall away rapidly through October and November into the high 40s. January and February are the coldest months with temperatures hovering around freezing or slightly above in higher areas and in the high 40s along the coast. Temperatures at night are usually 10 to as much as 15 degrees Fahrenheit colder depending on where you are in the

country.
October through January are the wettest months. Rain tends to fall in short, sharp and very heavy showers. November is particularly squally with rain accompanied by gusty winds.

38. Просмотрите текст и ответьте на вопрос: “Why is Scotland is the land of myths and mysteries? “

Scotland is a country in the north of Great Britain. It is a part of the United Kingdom. Scotland is divided into three natural regions: the Southern Uplands, the Central Lowlands and the Highlands and islands. A lot of places in Scotland are a natural paradise, still untouched by man.
The capital of Scotland is Edinburgh, well known for its castle. Glasgow is the industrial capital of Scotland. It is the third largest city in Great Britain. The typical products of Scotland are timber, whisky, salmon. Golf is the Scottish natural sport and it seems to have originated in this country.
Scotland is also the land of myths and mysteries; every castle has its ghost. Glamis Castle is said to have nine of them. And of course everyone knows about the Loch Ness Monster. 'Nessie" is said to be about six meters long, with a long, thin neck. The first report of the monster in Loch Ness was in 565 A.D. Since 1934, thousands of people claimed to they had seen the monster. Scientists have investigated the Loch and taken pictures but no scientific explanation of the mystery has been given.
Scotland is the north part of Great Britain. Five million people live in Scotland. Edinburgh is the capital of Scotland.

39. Просмотрите текст и ответьте на вопрос: “What is the London Eye?“

The London Eye, or the Millennium Wheel, is a cantilevered observation wheel on the South Bank of the River Thames in London. It is Europe's tallest cantilevered observation wheel, and is the most popular paid tourist attraction in the United Kingdom with over 3 million visitors annually. It has made many appearances in popular culture.
The structure is 135 metres (443 ft) tall and the wheel has a diameter of 120 metres (394 ft). When it opened to the public in 2000 it was the world's tallest Ferris wheel. Its height was surpassed by the 167 metres (548 ft) High Roller (Las Vegas) in 2014. Supported by an A-frame on one side only, unlike the taller Nanchang and Singapore wheels, the Eye is described by its operators as "the world's tallest cantilevered observation wheel".
The London Eye used to offer the highest public viewing point in London until it was superseded by the 245-metre-high (804 ft) observation deck on the 72nd floor of The Shard, which opened to the public on 1 February 2013.
In March 2020, the London Eye celebrated its 20th birthday by turning several of its pods into experiences themed around London, in partnership with its sponsor lastminute.com. The special experiences included a pub in a capsule, a west end theatre pod and a garden party with flower arrangements to represent the eight London Royal parks.

40. Просмотрите текст и ответьте на вопрос: "The Global Waste Crisis"

The Global Waste Crisis
Every year, the world generates over 2 billion tons of municipal solid waste, with plastic, electronic waste (e-waste), and food waste being major contributors. Landfills and incineration—traditional waste disposal methods—release harmful greenhouse gases (like methane and CO_2) and toxic chemicals, accelerating climate change and pollution.
Green Technology Solutions for Waste Management
1. Smart Recycling Systems
o AI-powered waste sorting robots (e.g., ZenRobotics) use machine learning to separate recyclables with high precision.
o Blockchain-based tracking ensures transparent recycling processes, reducing illegal dumping.
2. Waste-to-Energy (WtE) Technologies
o Biogas plants convert organic waste into renewable energy.
o Plasma gasification breaks down non-recyclable waste into clean syngas for electricity.
3. Circular Economy & Sustainable Materials

- Companies like TerraCycle upcycle hard-to-recycle waste into new products.
- Biodegradable packaging (e.g., Mushroom-based materials, seaweed plastics) replaces single-use plastics.

4. E-Waste Innovations
- Urban mining extracts precious metals (gold, lithium) from discarded electronics.
- Modular smartphones (e.g., Fairphone) reduce e-waste by enabling easy repairs.

5. Zero-Waste Initiatives
- Cities like San Francisco aim for zero waste through strict recycling/composting laws.
- Edible cutlery and reusable container programs cut down disposable waste.

41. Ответьте на вопрос:

What places of interest are there in London?

42. Ответьте на вопрос:

What can you say about the system of higher education in Russia?

43. Ответьте на вопрос:

Does Russia have a borderline with the USA?

44. Ответьте на вопрос:

What is the longest river in the European part of Russia? What can you say about it?

45. Ответьте на вопрос:

What do you know about climate in England?

46. Ответьте на вопрос:

In what wat have computers changed our life?

47. Ответьте на вопрос:

What do you know about theaters in Moscow?

48. Ответьте на вопрос:

“How do you feel about artificial intelligence like Siri and Alexa?”

49. Ответьте на вопрос:

“How have technological advances affected communication ?”

50. Ответьте на вопрос:

“How have technological advances affected education?”

51. Ответьте на вопрос:

“ What do you think is the biggest advantage of modern technology?”

52. Ответьте на вопрос:

“Is there a tech product you want these days? What is it? How will it make your life better?”

53. Ответьте на вопрос:

“ How has technology impacted our work, studies and career?”

54. Ответьте на вопрос:

“What do you think is the most important breakthrough in history ?”

55. Ответьте на вопрос:

“What industrial applications of electricity do you know ?”

56. Ответьте на вопрос:

“What makes it possible to eliminate air and water pollution?”

57. Ответьте на вопрос:

“What actions are necessary to take to deal successfully with the problem of protecting the environment throughout the world ?”

58. Ответьте на вопрос:

“What interesting facts do you know about the University of Cambridge?”

59. Ответьте на вопрос:

“What sights are there in London ?”

60. Ответьте на вопрос:

“What are you favorite places of interest in Moscow ?”

3 семестр, Экзамен

Контролируемые ИДК: УК-4.1 УК-5.1 УК-4.2 УК-5.2 УК-4.3 УК-5.3 УК-4.4 УК-5.4

Вопросы/Задания:

1. Translate the text (1800 printed characters; time – 60 min.)

To understand the properties of modern optoelectronic devices, as well as a number of other devices in the real world, it is imperial to discuss first of all the PN junction diode - the fundamental building block of the modern electronic age. A silicon atom consists of fourteen negatively-charged electrons surrounding a central nucleus - the charge of the nucleus makes the atom neutral. A lattice of silicon atoms is known as an Intrinsic semiconductor, and consists of a single silicon atom bonded to four neighboring atoms covalently. This meansthat holes, or a lack of an electron in an atoms band, inthe valence band are vacancies created by electrons that have been thermally excited to the conduction band. This thermal excitation can arise when energy has been applied to the atom in the form of heat energy, or light of a specific wavelength. A single atom of boron, as well as a single atom of arsenic, has not net electric charge. Boron and arsenic appear on the periodic table to the left and right of silicon respectively. This means the number of electrons in the valence band are lower and higher respectively. In the process of ”doping,” atoms of boron, for example, can be added to the silicon crystal to decrease the total amount of electrons present. The same process can be applied to a silicon lattice with an atom of arsenic; in this case, the arsenic increase the number of electrons in the semi-conductor. This electron is now free to move around the crystal, with much less energy applied than in the case of the normal silicon lattice. In the case of both dopant, there is now a charge associated; with excess holes, the semiconductor becomes p-type. With excess electrons, the semiconductor becomes n-type. Both semiconductors are extrinsic. The amount of doping can be increased or decreased, depending on the situation

2. Translate the text (1800 printed characters; time – 60 min.)

P-N Junction Photodiode

It is a two-terminal junction device which is operated by first reverse-biasing the junction and then illuminating it. A reverse-biased P-N junction has a small amount of reverse saturation current Is (or I0) due to thermally-generated electron-hole pairs. In silicon, Is is the range of nanoamperes. The number of these minority carriers depends on the intensity of light incident on the junction. When the diode is in glass package, light can reach the junction and thus change the reverse current.

The basic biasing arrangement, construction and symbols of a photodiode are shown in Fig. 53.8. As seen, a lens has been used in the cap of the unit to focus maximum light on the reverse-biased junction. The active diameter of these devices is about 2.5 mm but they are mounted in standard TO-5 packages with a window to allow maximum incident light.

The characteristics of Fig. 53.9 show that for a given reverse voltage, Iλ (or Is) increases with increase in the level of illumination. The dark current refers to the current that flows when no light is incident.

By changing the illumination level, reverse current can be changed. In this way, reverse resistance of the diode can be changed by a factor of nearly 20.

A photodiode can turn its current ON and OFF in nanoseconds. Hence, it is one of the fastest photodetectors. It is used where it is required to switch light ON and OFF at a maximum rate. Applications of a photodiode include

1.detection, both visible and invisible ;
2. demodulation ;
3. switching ;
4. logic circuit that require stability and high speed ;
5. character recognition ;
6. optical communication equipment ;
7. encoders etc.

3. Translate the text (1800 printed characters; time – 60 min.)

Advantages of Liquid Crystals Displays

An LCD has the distinct advantage of extremely low power requirement (about 10-15 μW per 7-segment display as compared to a few mW for a LED). It is due to the fact that it does not itself

generate any illumination but depends on external illumination for its visual effect (colour depending on the incident light). They have a life-time of about 50,000 hours.

(e) Uses

1. Field-effect LCDs are normally used in watches and portable instruments where source of energy is a prime consideration.
2. Thousands of tiny LCDs are used to form the picture elements (pixels) of the screen in one type of B & W pocket TV receiver.
3. Recent desk top LCD monitors.
4. Note book computer display
5. Cellular phone display, to display data on personal digital assistant (PDAs) such as Palm Vx etc.

The liquid crystal display (LCDs) commonly used on notebook computers and handheld PDAs are also appearing on desktop. These flat panel displays promise great clarity at increasingly high resolutions and are available in screen sizes up to 15 inches. The LCD monitor offers benefits and drawbacks. The first benefit is size. Because of the need to house the tube itself, cathode-ray tube (CRT) monitors are big and heavy. LCD monitors are only a few inches deep and they are much lighter in weight. However LCD monitors are expensive than CRTs at present. Another problem is the viewing angle. The optimal viewing angle of an LCD is from straight in front and as you move further to the side the screen becomes harder to read, much more so than with a CRT. Moreover screen resolutions generally reach only as high as 1,024 × 768, which is insufficient for some applications.

4. Translate the text (1800 printed characters; time – 60 min.)

Liquid Crystals Displays

(a) General

A liquid crystal is a material (usually, an organic compound) which flows like a liquid at room temperature but whose molecular structure has some properties normally associated with solids (examples of such compounds are : cholesteryl nonanoate and p-azoxyanisole). As is well-known, the molecules in ordinary liquids have random orientation but in a liquid crystal they are oriented in a definite crystal pattern. Normally, a thin layer of liquid crystal is transparent to incident light but when an electric field is applied across it, its molecular arrangement is disturbed causing changes in its optical properties. When light falls on an activated layer of a liquid crystal, it is either absorbed or else is scattered by the disoriented molecules.

(b) Construction

A liquid crystal 'cell' consists of a thin layer (about 10 μm) of a liquid crystal sandwiched between two glass sheets with transparent electrodes deposited on their inside faces. With both glass sheets transparent, the cell is known as transmittive type cell. When one glass is transparent and the other has a reflective coating, the cell is called reflective type. The LCD does not produce any illumination of its own. It, in fact, depends entirely on illumination falling on it from an external source for its visual effect.

(c) Working

The two types of display available are known as (i) field-effect display and (ii) dynamic scattering display. When field-effect display is energized, the energized areas of the LCD absorb the incident light and, hence give localized black display. When dynamic scattering display is energized, the molecules of energized area of the display become turbulent and scatter light in all directions. Consequently, the activated areas take on a frosted glass appearance resulting in a silver display. Of course, the un-energized areas remain translucent.

A digit on an LCD has a segment appearance. For example, if number 5 is required, the terminals 8, 2, 3, 6 and 5 would be energized so that only these regions would be activated while the other areas would remain clear.

5. Translate the text (1800 printed characters; time – 60 min.)

Photoconductive Cell

It is a semiconductor device whose resistance varies inversely with the intensity of light that falls upon it. It is also known as photoresistive cell or photoresistor because it operates on the principle of photoresistivity.

(a) Theory

The resistivity (and, hence, resistance) of a semiconductor depends on the number of free charge carriers available in it. When the semiconductor is not illuminated, the number of charge carriers is small and, hence, resistivity is high. But when light in the form of photons strikes the semiconductor, each photon delivers energy to it. If the photon energy is greater than the energy band gap of the semiconductor, free mobile charge carriers are liberated and, as a result, resistivity of the semiconductor is decreased.

(b) Construction and Working

Photoconductive cells are generally made of cadmium compounds such as cadmium sulphide (CdS) and cadmium selenide (CdSe). Spectral response of CdS cell is similar to the human eye, hence such cells are often used to simulate the human eye. That is why they find use in light metering circuits in photographic cameras.

The construction of a typical photo conductive cell and its two alternative circuit symbols are shown in Fig. 53.11 (a) and (b) respectively. As seen, a thin layer of photosensitive semiconductor material is deposited in the form of a long strip zig-zagged across a disc-shaped ceramic base with protective sides. For added protection, a glass lens or plastic cover is used. The two ends of the strip are brought out to connecting pins below the base.

The terminal characteristic of a photoconductive cell is shown in Fig. 53.12. It depicts how the resistance of the cell varies with light intensity. Typically, the dark resistance of the cell is 1 MΩ or larger. Under illumination, the cell resistance drops to a value between 1 and 100 kΩ depending on surface illumination.

6. Translate the text (1800 printed characters; time – 60 min.)

Phototransistor

It is light-sensitive transistor and is similar to an ordinary bipolar junction transistor (BJT) except that it has no connection to the base terminal. Its operation is based on the photodiode that exists at the CB junction. Instead of the base current, the input to the transistor is provided in the form of light as shown in the schematic symbol of Fig. 53.14 (a).

Silicon NPNs are mostly used as photo transistors. The device is usually packed in a TO-type can with a lens on top although it is sometimes encapsulated in clear plastic. When there is no incident light on the CB junction, there is a small thermally-generated collectorto-emitter leakage current ICEO which, in this case, is called dark current and is in the nA range.

When light is incident on the CB junction, a base current $I\lambda$ is produced which is directly proportional to the light intensity. Hence, collector current $IC = \beta I\lambda$

Typical collector characteristic curves of a phototransistor are shown in Fig. 53.14 (b). Each individual curve corresponds to a certain value of light intensity expressed in mW/cm2. As seen, IC increases with light intensity.

The phototransistor has applications similar to those of a photodiode. Their main differences are in the current and response time. The photo-transistor has the advantages of greater sensitivity and current capacity than photodiodes. However, photodiodes are faster of the two, switching in less than a nanosecond.

7. Look through the text and say what it is about. Give its brief contents.

An imperfection or distortion in an image is called an aberration. An aberration can be produced by a flaw in a lens or mirror, but even with a perfect optical surface some degree of aberration is unavoidable. To see why, consider the mathematical approximation we've been making, which is that the depth of the mirror's curve is small compared to do and di. Since only a flat mirror can satisfy this shallow-mirror condition perfectly, any curved mirror will deviate somewhat from the mathematical behavior we derived by assuming that condition. There are two main types of aberration in curved mirrors, and these also occur with lenses.

An object on the axis of the lens or mirror may be imaged correctly, but off-axis objects may be out of focus or distorted. In a camera, this type of aberration would show up as fuzziness or warping near the sides of the picture when the center was perfectly focused. An example of this is shown in figure

a), and in that particular example, the aberration is not a sign that the equipment was of low quality or wasn't right for the job but rather an inevitable result of trying to flatten a panoramic view; in the limit of a 360-degree panorama, the problem would be similar to the problem of representing the Earth's surface on a flat map, which can't be accomplished without distortion.

8. Look through the text and say what it is about. Give its brief contents.

The fundamental physical phenomenon at work in the eye is that when light crosses a boundary between two media (such as air and the eye's jelly), part of its energy is reflected, but part passes into the new medium. In the ray model of light, we describe the original ray as splitting into a reflected ray and a transmitted one (the one that gets through the boundary). Of course the reflected ray goes in a direction that is different from that of the original one, according to the rules of reflection we have already studied. More surprisingly — and this is the crucial point for making your eye focus light — the transmitted ray is bent somewhat as well. This bending phenomenon is called refraction. The origin of the word is the same as that of the word "fracture," i.e., the ray is bent or "broken." (Keep in mind, however, that light rays are not physical objects that can really be "broken.") Refraction occurs with all waves, not just light waves.

The actual anatomy of the eye, b), is quite complex, but in essence it is very much like every other optical device based on refraction. The rays are bent when they pass through the front surface of the eye, c). Rays that enter farther from the central axis are bent more, with the result that an image is formed on the retina. There is only one slightly novel aspect of the situation. In most human-built optical devices, such as a movie projector, the light is bent as it passes into a lens, bent again as it reemerges, and then reaches a focus beyond the lens. In the eye, however, the "screen" is inside the eye, so the rays are only refracted once, on entering the jelly, and never emerge again.

9. Look through the text and say what it is about. Give its brief contents.

What are the rules governing refraction? The first thing to observe is that just as with reflection, the new, bent part of the ray lies in the same plane as the normal (perpendicular) and the incident ray, d).

If you try shooting a beam of light at the boundary between two substances, say water and air, you'll find that regardless of the angle at which you send in the beam, the part of the beam in the water is always closer to the normal line, e). It doesn't matter if the ray is entering the water or leaving, so refraction is symmetric with respect to time-reversal, f).

If, instead of water and air, you try another combination of substances, say plastic and gasoline, again you'll find that the ray's angle with respect to the normal is consistently smaller in one and larger in the other. Also, we find that if substance A has rays closer to normal than in B, and B has rays closer to normal than in C, then A has rays closer to normal than C. This means that we can rank-order all materials according to their refractive properties. Isaac Newton did so, including in his list many peculiar substances. Several general rules can be inferred from such a list:

* Vacuum lies at one end of the list. In refraction across the interface between vacuum and any other medium, the other medium has rays closer to the normal.
* Among gases, the ray gets closer to the normal if you increase the density of the gas by pressurizing it more.

10. Look through the text and say what it is about. Give its brief contents.

What neither Snell nor Newton knew was that there is a very simple interpretation of the index of refraction. This may come as a relief to the reader who is taken aback by the complex reasoning involving proportionalities that led to its definition. Later experiments showed that the index of refraction of a medium was inversely proportional to the speed of light in that medium. Since c is defined as the speed of light in vacuum, and n = 1 is defined as the index of refraction of vacuum, we have

$$n = \ /$$

[n = medium's index of refraction, v = speed of light in that medium, c = speed of light in a vacuum]. Many textbooks start with this as the definition of the index of refraction, although that approach makes the quantity's name somewhat of a mystery, and leaves students wondering why c/v was used rather than v/c. It should also be noted that measuring angles of refraction is a far more practical method for determining n than direct measurement of the speed of light in the substance of interest.

11. Look through the text and say what it is about. Give its brief contents.

Why should refraction be related to the speed of light? The mechanical model shown in the figure may help to make this more plausible. Suppose medium 2 is thick, sticky mud, which slows down the car. The car's right wheel hits the mud first, causing the right side of the car to slow down. This will cause the car to turn to the right until is moves far enough forward for the left wheel to cross into the mud. After that, the two sides of the car will once again be moving at the same speed, and the car will go straight.

Of course, light isn't a car. Why should a beam of light have anything resembling a "left wheel" and "right wheel?" After all, the mechanical model would predict that a motorcycle would go straight, and a motorcycle seems like a better approximation to a ray of light than a car. The whole thing is just a model, not a description of physical reality.

12. Look through the text and say what it is about. Give its brief contents.

Earlier, we developed an equation for the percentage of the wave energy that is transmitted and the percentage reflected at a boundary between media. This was only done in the case of waves in one dimension, however, and rather than discuss the full three dimensional generalization it will be more useful to go into some qualitative observations about what happens. First, reflection happens only at the interface between two media, and two media with the same index of refraction act as if they were a single medium. Thus, at the interface between media with the same index of refraction, there is no reflection, and the ray keeps going straight. Continuing this line of thought, it is not surprising that we observe very little reflection at an interface between media with similar indices of refraction.

The next thing to note is that it is possible to have situations where no possible angle for the refracted ray can satisfy Snell's law. Solving Snell's law for Θ2, we find

$$\theta_2 = \sin^{-1}\left({}_1 / {}_2 \sin \theta 1 \right)$$

and if n1 is greater than n2, then there will be large values of Θ1 for which the quantity (n1/n2)sin Θ is greater than one, meaning that your calculator will flash an error message at you when you try to take the inverse sine. What can happen physically in such a situation? The answer is that all the light is reflected, so there is no refracted ray. This phenomenon is known as total internal reflection, and is used in the fiber-optic cables that nowadays carry almost all long-distance telephone calls.

13. Answer the question:

What are typical components of a laser?

14. Answer the question:

What is the difference between 'ordinary' light and laser light?

15. Answer the question:

Who offered the atomic structure of emission of light? How many models do you know?

16. Answer the question:

How did Newton describe the nature of light?

17. Answer the question:

Do electric and magnetic fields deflect light beams?

18. Answer the question:

When are the wave and particle models of light necessary? Provide examples.

19. Look through the text and say what it is about. Give its brief contents.

Miniaturization in Optical Systems: Trends and Impact

The ongoing miniaturization of optoelectronic systems is reshaping modern technology, enabling compact, high-performance devices with applications spanning consumer electronics, healthcare, and industrial automation. By integrating optical components into increasingly smaller form factors, engineers are unlocking new possibilities in functionality, portability, and energy efficiency.

One of the most visible impacts of this trend is in consumer electronics, where miniaturized optical systems power smartphones, wearables, and augmented reality (AR) devices. Compact cameras with advanced multi-lens arrays, tiny depth sensors for facial recognition, and micro-displays for AR glasses all rely on precision optics scaled down to millimeter dimensions. These innovations are made possible through advancements in micro-optics fabrication, wafer-level packaging, and hybrid integration of photonic circuits.

In healthcare, miniaturization has led to breakthroughs in portable diagnostics and minimally invasive medical tools. Endoscopic capsules with integrated optical sensors can now navigate the human body, transmitting high-resolution images for internal examinations. Similarly, miniaturized spectrometers and lab-on-a-chip devices enable rapid, point-of-care blood analysis and disease detection, bringing sophisticated medical diagnostics out of laboratories and into the field.

20. Look through the text and say what it is about. Give its brief contents.

Miniaturization in Optical Systems: Trends and Impact

Telecommunications is another sector benefiting from smaller optical systems. Silicon photonics allows optical transceivers and switches to be integrated onto microchips, boosting data center performance while reducing power consumption and footprint. This is critical as demand grows for faster, more energy-efficient data transmission in cloud computing and 5G/6G networks.

Industrial and defense applications also leverage miniaturized optical systems for compact sensing and imaging solutions. Drones and robotics employ lightweight LiDAR and thermal imaging modules for navigation and inspection, while military systems use micro-optical components in targeting systems and wearable heads-up displays.

Despite progress, challenges remain in maintaining performance and reliability at reduced scales. Thermal management, alignment precision, and manufacturing yield are key hurdles. Emerging techniques like 3D-printed optics, metasurfaces, and quantum dot integration offer promising pathways to overcome these limitations.

The future of optical system miniaturization lies in further convergence with semiconductor technologies and AI-driven design optimization. As components shrink to near-invisible scales, their applications will expand into flexible electronics, implantable medical devices, and ubiquitous IoT sensors, solidifying optics as a cornerstone of next-generation technology.

21. Look through the text and say what it is about. Give its brief contents.

AI-Driven Data Processing in Optical Systems: Transforming Light into Intelligence

The integration of artificial intelligence (AI) into optical system data processing is revolutionizing how we capture, interpret, and utilize light-based information. By combining advanced machine learning algorithms with high-speed photonic data streams, modern optical systems are achieving unprecedented levels of speed, accuracy, and functionality across diverse applications.

At the core of this transformation lies AI's ability to handle massive datasets generated by optical sensors and imaging systems. Traditional signal processing methods often struggle with noise reduction in low-light conditions or real-time analysis of high-dimensional data. Deep learning approaches, particularly convolutional neural networks (CNNs), now enable automated feature extraction from complex optical patterns, dramatically improving image reconstruction in microscopy, astronomical imaging, and medical diagnostics.

In industrial quality control, AI-enhanced optical inspection systems can detect sub-micron defects at production-line speeds that surpass human capabilities. By training on vast libraries of product images, these systems learn to identify anomalies with superhuman precision while continuously improving through adaptive learning. Similarly, in autonomous vehicles, AI algorithms fuse data from LiDAR, cameras, and other optical sensors to create comprehensive environmental models in real time, enabling split-second navigation decisions.

Spectroscopic analysis has particularly benefited from AI integration. Where conventional methods require careful calibration and expert interpretation, machine learning models can instantly identify molecular fingerprints in complex spectral data. This capability is transforming fields from pharmaceutical analysis to environmental monitoring, where portable spectrometers paired with edge AI can provide immediate chemical composition readings in the field.

22. Look through the text and say what it is about. Give its brief contents.

AI-Driven Data Processing in Optical Systems: Transforming Light into Intelligence

The telecommunications sector leverages AI for optimizing fiber-optic network performance. Neural networks predict and compensate for signal distortions in dense wavelength-division multiplexing (DWDM) systems, maximizing bandwidth while minimizing power consumption. In free-space optical communications, AI helps mitigate atmospheric turbulence effects, maintaining stable

high-bandwidth links.
Emerging applications push these capabilities further. In computational imaging, AI reconstructs high-resolution images from under-sampled or scattered light data, enabling novel microscope designs and through-obstacle imaging. Quantum optical systems employ machine learning to characterize and control quantum states of light, crucial for developing quantum communication networks.
While offering tremendous potential, AI-enhanced optical processing faces challenges including the need for specialized training datasets, computational resource demands, and maintaining interpretability in decision-making. Ongoing advances in neuromorphic photonics - where optical hardware mimics neural network architectures - promise to address these limitations by enabling ultrafast, energy-efficient AI processing directly in the optical domain.
As AI algorithms grow more sophisticated and optical systems more ubiquitous, their synergy is creating smart vision systems that don't just capture light, but understand and respond to visual information with human-like perception. This convergence is setting new standards across industries while opening frontiers in scientific research, from analyzing telescope imagery to decoding neural activity through optical brain-computer interfaces.

23. Look through the text and say what it is about. Give its brief contents.

Optical Systems in Disaster Response: Illuminating Critical Solutions

In disaster response scenarios, where time and accuracy are paramount, optical systems have emerged as vital tools for rapid assessment, situational awareness, and life-saving interventions. These light-based technologies provide first responders and relief organizations with real-time, high-resolution data in environments where conventional methods may fail, offering critical advantages across all phases of disaster management.
The immediate aftermath of earthquakes, hurricanes, or industrial accidents demands swift damage assessment over large areas. Here, LiDAR-equipped drones and aircraft generate centimeter-accurate 3D maps of affected zones, revealing structural damage, blocked roads, and terrain changes invisible to traditional satellite imagery. Combined with multispectral imaging, these systems can detect gas leaks, chemical spills, or hidden heat signatures from survivors trapped under rubble. Thermal cameras, another optical technology, enable night-time search operations and can locate victims through smoke or dense vegetation by their body heat signatures.
Optical fiber sensors demonstrate remarkable versatility in disaster prevention and early warning systems. Distributed acoustic sensing (DAS) technology transforms ordinary fiber cables into thousands of virtual microphones capable of detecting ground vibrations from potential landslides or underground shifts preceding earthquakes. Similarly, fiber-optic strain sensors monitor critical infrastructure like dams, bridges, and pipelines, providing continuous structural health data that can predict failures before they occur.
Communication breakdowns during disasters are often addressed through free-space optical (FSO) links, which establish high-bandwidth laser connections between temporary command centers when conventional networks fail. These systems deploy rapidly, unaffected by radio frequency congestion, and can transmit high-definition video feeds from disaster zones to coordination hubs. Miniaturized versions now integrate with portable emergency kits carried by first responders.

24. Look through the text and say what it is about. Give its brief contents.

Optical Systems in Disaster Response: Illuminating Critical Solutions
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Chemical and biological hazard detection represents another crucial application. Compact Raman spectrometers and laser-induced breakdown spectroscopy (LIBS) devices allow field teams to instantly identify toxic substances in air, water, or on surfaces without physical sampling. Recent

integrations with AI enable these systems to recognize complex contaminant mixtures and recommend appropriate safety protocols.

Looking ahead, emerging technologies like quantum-enhanced imaging promise to revolutionize disaster response further. Quantum LiDAR systems under development could peer through dense smoke or fog with unprecedented clarity, while hyperspectral imagers may soon distinguish between similar-looking materials—critical when identifying safe versus compromised structures.

Despite their advantages, challenges remain in making these technologies more rugged, power-efficient, and operable by non-specialists. The future lies in networked optical systems—interconnected arrays of ground, aerial, and orbital sensors that provide comprehensive, real-time disaster monitoring. As climate change increases the frequency and severity of catastrophic events, optical systems will continue evolving as indispensable tools for protecting lives and accelerating recovery efforts worldwide.

25. Look through the text and say what it is about. Give its brief contents.

Optical Systems in Water Resource Management: Advanced Monitoring and Protection

Water resource management has become increasingly dependent on optical-electronic systems, which provide precise, real-time data for maintaining water quality, managing aquatic ecosystems, and ensuring sustainable usage. These technologies enable scientists and policymakers to monitor water bodies with unprecedented accuracy, from vast oceans to underground aquifers, supporting critical decisions in conservation, agriculture, and urban planning.

One of the most significant applications is in assessing water quality. Hyperspectral imaging, deployed via satellites, drones, or stationary sensors, detects subtle changes in water composition by analyzing light absorption and scattering patterns. This allows for the identification of harmful algal blooms, suspended sediments, and organic pollutants before they escalate into ecological crises. Combined with AI-driven data processing, these systems can predict toxin outbreaks in reservoirs, enabling preemptive measures to protect drinking water supplies.

LiDAR technology, particularly bathymetric LiDAR, plays a crucial role in mapping underwater terrain and monitoring sediment transport in rivers, lakes, and coastal zones. By penetrating shallow waters with laser pulses, it generates high-resolution 3D maps that help track erosion, assess flood risks, and plan dredging operations. In marine environments, underwater LiDAR systems study coral reef health, detecting bleaching events and structural damage caused by climate change or human activity.

Fiber-optic sensing networks are revolutionizing groundwater monitoring by providing distributed temperature and strain measurements along entire watercourses. These systems detect leaks in pipelines, track thermal pollution from industrial discharges, and monitor saltwater intrusion in coastal aquifers—all in real time. Unlike traditional spot measurements, fiber-optic cables offer continuous coverage, making them indispensable for early warning systems in vulnerable regions.

Emerging techniques like laser-induced fluorescence spectroscopy are enhancing the detection of microplastics and chemical contaminants. By analyzing the unique fluorescent signatures of pollutants, these portable systems enable rapid field assessments without time-consuming lab tests. Similarly, Raman spectroscopy identifies dissolved hydrocarbons and heavy metals, supporting regulatory enforcement and spill response efforts.

Future advancements aim to integrate these optical systems with autonomous underwater vehicles (AUVs) and IoT networks, creating smart water grids that self-monitor and adapt to environmental changes. Quantum-based optical sensors may soon push detection limits further, identifying trace contaminants at the molecular level. As water scarcity intensifies globally, optical systems will remain at the forefront of sustainable management, ensuring this vital resource is protected for future generations.

26. Look through the text and say what it is about. Give its brief contents.

Optical Systems in Modern Forest Management: A Vision for Sustainable Stewardship

The integration of advanced optical systems into forest management has revolutionized how we monitor, protect, and sustainably utilize one of Earth's most vital ecosystems. These light-based technologies provide foresters, ecologists, and conservationists with tools to observe forest dynamics at unprecedented scales and resolutions, enabling data-driven decisions that balance ecological preservation with resource utilization.

At the landscape level, airborne LiDAR systems have become indispensable for creating detailed three-dimensional maps of forest structure. By emitting laser pulses from aircraft or drones, these systems penetrate dense canopies to measure tree height, crown volume, and understory vegetation with centimeter-level accuracy. This data supports precise biomass estimation, carbon stock assessment, and identification of old-growth forest areas requiring special protection. When combined with hyperspectral imaging, the technology goes beyond structural analysis to detect subtle changes in plant health, revealing early signs of drought stress, disease outbreaks, or nutrient deficiencies before they become visible to the naked eye.

Satellite-based optical monitoring provides the big picture for global forest tracking. Multispectral sensors with regular revisit capabilities document deforestation patterns, illegal logging activities, and regeneration progress across vast territories. Modern processing algorithms can automatically detect changes in forest cover, distinguishing between natural disturbances like wildfires and human-induced alterations. These systems form the backbone of international initiatives such as REDD+ (Reducing Emissions from Deforestation and Forest Degradation), providing verifiable data for climate change mitigation programs.

On the ground, portable optical tools bring laboratory-grade analysis to field operations. Compact spectrometers assess wood quality and moisture content during harvesting operations, while thermal cameras help locate wildlife nests or identify microhabitats requiring protection during forestry activities. Terrestrial laser scanners mounted on tripods create ultra-high-resolution models of sample plots, allowing researchers to study competition between individual trees and model growth patterns under different management scenarios.

Emerging technologies are pushing the boundaries further. Quantum lidar systems under development promise to detect single photons reflected from vegetation, potentially enabling nighttime forest monitoring and improved measurements in dense fog or smoke. Hyperspectral imaging from low-cost drones is democratizing access to detailed forest health data, allowing small communities and indigenous groups to participate actively in forest stewardship.

The future of optical forest management lies in integrated sensor networks that combine space, air, and ground observations into unified digital twins of forest ecosystems. These virtual replicas, updated in near real-time, will enable predictive modeling of forest responses to climate change, optimized harvest planning, and early warning systems for pest outbreaks. As optical sensors become smaller, smarter, and more energy-efficient, they will increasingly merge with the forest environment itself – from smart tags monitoring individual trees to biodegradable optical sensors dispersed through woodland areas.

This optical revolution in forest management comes with challenges, including data overload, the need for specialized training, and ensuring equitable access to technology across nations and communities. However, the potential benefits for sustainable forestry, biodiversity conservation, and climate change mitigation make optical systems an essential investment for preserving the world's forests in the 21st century and beyond.

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The Critical Role of Resolution in Optical Systems

Resolution stands as one of the most fundamental parameters defining the performance and application potential of optical systems. This key characteristic determines a system's ability to distinguish fine details, separate closely spaced objects, and deliver meaningful data across scientific, industrial, and consumer applications. The pursuit of higher resolution in optical technologies continues to drive innovation while presenting unique engineering challenges that shape system design and implementation.

In imaging systems, resolution directly impacts the quality and utility of captured visual information. High-resolution cameras with advanced sensor arrays and precision optics enable scientists to observe cellular structures in biomedical research, astronomers to resolve distant celestial objects, and manufacturers to detect microscopic defects in quality control processes. The evolution from standard definition to 4K/8K imaging in consumer electronics demonstrates how resolution improvements transform user experiences, while specialized systems like gigapixel cameras push boundaries in surveillance and large-format photography.

Spectral resolution plays an equally vital role in analytical applications. High-resolution

spectrometers can distinguish between molecular fingerprints with minute wavelength differences, enabling precise material identification in chemistry, environmental monitoring, and pharmaceutical analysis. The development of hyperspectral imaging systems with hundreds of narrow spectral bands has revolutionized fields from agriculture to mineral exploration by providing detailed chemical composition maps alongside traditional imagery.

Spatial resolution in LiDAR and 3D scanning systems determines their ability to model fine geometric features. Forestry applications require sufficient resolution to identify individual branches and leaves for accurate biomass estimation, while archaeological surveys demand centimeter-level precision to document subtle terrain variations. The emergence of single-photon LiDAR technologies has dramatically improved resolution capabilities, allowing detailed mapping from higher altitudes and through partial obstructions.

Temporal resolution represents another critical dimension, particularly in dynamic systems. High-speed cameras with microsecond resolution capture transient phenomena in material science and ballistics studies, while frequent-revisit satellite constellations provide near-real-time monitoring of environmental changes. The balance between spatial and temporal resolution often presents key design trade-offs that engineers must carefully evaluate based on application requirements.

The quest for higher resolution faces physical limitations imposed by diffraction, sensor noise, and atmospheric conditions. Innovative solutions like computational imaging techniques, adaptive optics, and super-resolution algorithms help overcome these barriers. Synthetic aperture approaches combine multiple lower-resolution observations to achieve effectively higher resolution, while quantum imaging technologies promise to break traditional resolution limits through photon correlation techniques.

As optical systems continue advancing, resolution remains a central focus driving both technical innovation and practical applications. From enabling new scientific discoveries to powering next-generation industrial inspection systems, the ability to resolve finer details continues expanding the boundaries of what optical technologies can achieve across every field of application. The ongoing development of higher-resolution systems promises to unlock new capabilities while simultaneously creating challenges in data processing, storage, and interpretation that will shape the future of optical engineering.

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The Critical Importance of Temporal Resolution in Optical Systems

Temporal resolution—the ability of an optical system to distinguish and capture events separated by small time intervals—serves as a fundamental parameter that determines how we observe and understand dynamic phenomena across scientific, industrial, and environmental applications. Unlike spatial resolution, which deals with the smallest distinguishable features in space, temporal resolution defines the system's capacity to freeze motion, track rapid changes, and reveal processes that unfold over milliseconds, microseconds, or even femtoseconds. This capability transforms optical systems from passive observers into powerful tools for analyzing transient events that would otherwise remain invisible to human perception or conventional instrumentation.

In scientific research, high temporal resolution enables the study of ultrafast processes that govern material properties, chemical reactions, and biological mechanisms. Femtosecond lasers paired with high-speed detectors allow researchers to capture molecular vibrations, electron transfers, and phase transitions in real time, providing insights that drive advancements in photochemistry, quantum physics, and nanotechnology. Similarly, in fluid dynamics, high-speed cameras with microsecond resolution reveal turbulence patterns and shockwave propagation that inform aircraft design, combustion optimization, and weather modeling.

Industrial applications rely heavily on temporal resolution for quality control and process monitoring. Manufacturing lines producing fast-moving goods require optical inspection systems capable of capturing sharp images of products traveling at high speeds without motion blur. In semiconductor fabrication, stroboscopic imaging with nanosecond timing precision detects defects in rapidly oscillating microelectromechanical systems (MEMS). The synchronization between illumination pulses and camera exposure becomes critical when examining vibrating components or rotating machinery, where even slight timing errors can lead to misinterpretation of mechanical behavior.

Environmental monitoring and Earth observation systems demonstrate how temporal resolution impacts large-scale phenomena tracking. Weather satellites with frequent revisit capabilities can

monitor storm development, wildfire spread, or flood progression in near real time, providing emergency responders with actionable data. In ecological studies, time-lapse optical systems track plant growth responses to environmental changes, while high-frequency coastal imaging captures shoreline dynamics affected by tides and storms. The choice of temporal resolution directly influences our ability to distinguish gradual processes from sudden events and establish causal relationships in complex natural systems.

Medical diagnostics and biomedical research present unique temporal resolution challenges. Optical coherence tomography (OCT) systems used in ophthalmology and cardiology must balance imaging speed with resolution to capture blood flow dynamics or retinal changes without motion artifacts. Advanced fluorescence microscopy techniques like strobed illumination overcome the limitations of detector readout speeds to study fast cellular processes, while laser Doppler systems measure blood perfusion with millisecond precision.

The pursuit of higher temporal resolution faces fundamental trade-offs with sensitivity, field of view, and data throughput. Extremely short exposure times require brighter illumination or more sensitive detectors to maintain signal quality, while high-speed imaging generates vast data streams that challenge storage and processing capabilities. Emerging technologies like compressed sensing and event-based cameras offer innovative solutions by capturing only changing image elements, dramatically reducing data loads while preserving temporal precision.

As optical systems continue advancing, temporal resolution remains a key frontier pushing the boundaries of observable phenomena. From studying atomic-scale electron dynamics to monitoring continental-scale weather patterns, the ability to resolve ever-shorter time intervals continues to expand our understanding of the physical world while creating new opportunities for technological innovation across all fields of science and industry. The ongoing development of attosecond optical techniques promises to open entirely new windows into the fundamental processes that govern light-matter interactions, ensuring temporal resolution will remain a vibrant area of research and engineering for years to come.

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Optical Systems in Pollution Detection: Illuminating Environmental Threats

Optical systems have become indispensable tools in the global effort to monitor and combat pollution, offering unparalleled capabilities for detecting, quantifying, and tracking contaminants across air, water, and soil. These light-based technologies provide real-time, non-contact measurement solutions that combine high sensitivity with the ability to analyze pollution sources over vast areas, transforming how environmental agencies and industries identify and mitigate ecological hazards.

Atmospheric monitoring represents one of the most critical applications of optical pollution detection systems. Differential Absorption Lidar (DIAL) systems employ precisely tuned laser beams to measure the concentration of airborne pollutants such as ozone, nitrogen oxides, and volatile organic compounds across vertical atmospheric profiles. By analyzing the wavelength-dependent absorption characteristics of these gases as laser light scatters back to detectors, researchers can create three-dimensional pollution maps spanning industrial zones or entire cities. Fourier-transform infrared (FTIR) spectrometers complement these measurements by continuously monitoring multiple gas species simultaneously, providing early warnings for toxic leaks or smog formation.

Water quality assessment has been revolutionized by advanced optical sensors capable of detecting contaminants at trace levels. Laser-induced fluorescence systems identify organic pollutants like petroleum hydrocarbons by exciting characteristic molecular vibrations and measuring the emitted fluorescent signatures. Raman spectroscopy probes the molecular composition of water samples in situ, distinguishing between different types of microplastics or identifying heavy metal complexes without requiring chemical reagents. Hyperspectral imaging from drones or satellites extends these capabilities to large water bodies, where it can track algal bloom dynamics, sediment plumes, or thermal pollution from industrial outflows across entire watersheds.

Industrial emissions monitoring relies increasingly on optical techniques that surpass traditional sampling methods in both speed and accuracy. Tunable diode laser absorption spectroscopy (TDLAS) systems installed in smokestacks provide continuous, second-by-second measurements of combustion byproducts like sulfur dioxide and carbon monoxide, enabling immediate process

adjustments to minimize environmental impact. Open-path ultraviolet and infrared spectrometers create perimeter monitoring networks around chemical plants, detecting fugitive emissions across wide areas with parts-per-billion sensitivity.

Emerging optical technologies are pushing detection limits even further. Quantum cascade lasers enable mid-infrared spectroscopy with unprecedented selectivity for complex organic pollutants. Hyperspectral LiDAR systems combine spatial mapping with chemical analysis, simultaneously identifying pollution sources and their dispersion patterns. Miniaturized optofluidic devices integrate optical sensing with microfluidics, creating lab-on-a-chip systems for field-deployable water analysis.

The integration of these optical systems with artificial intelligence and wireless sensor networks marks the next frontier in pollution surveillance. Smart optical nodes distributed throughout urban environments can autonomously detect abnormal pollution events, trace their origins through atmospheric modeling, and trigger alerts or mitigation systems. As climate change and industrialization intensify environmental pressures, optical detection systems will continue to evolve as essential guardians of ecosystem health, providing the data needed to enforce regulations, guide cleanup efforts, and ultimately protect human populations from pollution's invisible threats. Their ability to make the imperceptible visible ensures optical technologies will remain at the forefront of environmental protection strategies worldwide.

30. Look through the text and say what it is about. Give its brief contents.

Satellite Constellations in Remote Sensing: A New Era of Earth Observation

The advent of satellite constellations has fundamentally transformed the field of remote sensing, enabling unprecedented temporal and spatial coverage of Earth’s surface. Unlike traditional single-satellite missions, these coordinated networks of small, cost-effective satellites work in unison to provide near-continuous monitoring of environmental changes, urban development, and natural phenomena. By leveraging advancements in miniaturization, onboard processing, and data transmission, modern constellations deliver high-resolution imagery and multispectral data at frequencies that were unimaginable just a decade ago.

One of the most significant advantages of satellite constellations is their ability to drastically improve revisit rates. Where a conventional Earth observation satellite might pass over a given location once every few days or weeks, a well-designed constellation can image the same area multiple times per day. This high temporal resolution is invaluable for monitoring dynamic processes such as flood propagation, wildfire spread, or rapid urban expansion. Emergency responders now rely on near-real-time data from these systems to assess disaster impacts and coordinate relief efforts, while agriculturalists use frequent updates to track crop health and optimize irrigation.

The distributed nature of satellite constellations also enhances system resilience and data diversity. With dozens or even hundreds of satellites operating in coordinated orbits, the failure of any single unit does not compromise the entire network. This redundancy ensures uninterrupted data flow critical for long-term environmental monitoring programs. Furthermore, different satellites within a constellation can be equipped with specialized sensors—from high-resolution optical cameras to synthetic aperture radar (SAR) and hyperspectral imagers—providing complementary datasets that give a more comprehensive understanding of observed phenomena.

Small satellite technology has been the driving force behind this revolution. CubeSats and microsatellites, weighing just kilograms compared to traditional multi-ton satellites, can be produced and launched at a fraction of the cost while still carrying sophisticated imaging payloads. Advances in miniaturized spectrometers, lightweight optical systems, and AI-powered onboard processing allow these compact platforms to deliver data quality approaching that of their larger predecessors. The proliferation of commercial launch opportunities has further accelerated constellation deployment, enabling private companies to operate fleets of Earth observation satellites alongside government space agencies.

Looking ahead, the integration of satellite constellations with other emerging technologies promises even greater capabilities. The combination of space-based sensors with aerial drones and ground-based IoT networks will create multi-layer observation systems capable of zooming in from continental-scale monitoring to site-specific analysis. On-orbit data processing and edge computing will reduce latency by performing initial analysis aboard the satellites themselves, transmitting only

the most relevant information to ground stations. As machine learning algorithms become more sophisticated at extracting patterns from the vast streams of constellation-generated data, we stand on the brink of developing truly predictive environmental monitoring systems that can forecast ecological changes before they occur.

The environmental implications of this technology are profound. Satellite constellations now provide the most comprehensive dataset ever available for tracking climate change indicators, from glacial retreat and sea level rise to deforestation rates and ocean temperature anomalies. This global perspective is essential for verifying international climate agreements and coordinating transnational conservation efforts. As these systems continue to evolve, they will undoubtedly play an increasingly central role in humanity's efforts to understand and sustainably manage our planet's rapidly changing ecosystems. The era of satellite constellations has not just improved Earth observation—it has redefined what we can know about our world and how quickly we can know it.

31. Look through the text and say what it is about. Give its brief contents.

Future Trends in Optical System Development: Illuminating the Path Forward

The field of optical systems stands at the brink of a transformative era, driven by converging technological breakthroughs that promise to redefine what's possible in imaging, sensing, and light-based applications. As we look toward the coming decade, several key trends are emerging that will shape the next generation of optical-electronic technologies, pushing the boundaries of performance while making advanced optical solutions more accessible than ever before.

One of the most significant developments will be the widespread integration of artificial intelligence throughout the optical system pipeline. Future devices will increasingly incorporate neural network processing directly into optical hardware, enabling real-time image enhancement, feature recognition, and decision-making at the speed of light. Novel architectures like neuromorphic photonics will blur the line between optical components and computational elements, creating systems that can adapt their optical properties dynamically based on AI-driven analysis of incoming light patterns. This fusion of optics and machine intelligence will be particularly transformative in medical diagnostics, where smart microscopes could instantly identify pathological patterns, and in autonomous systems, where optical sensors will interpret complex visual scenes without traditional digital processing bottlenecks.

The miniaturization trend will accelerate, propelled by advancements in metasurfaces and flat optics. Traditional bulky lens assemblies will give way to ultra-thin optical components that manipulate light through precisely engineered nanostructures, enabling high-performance imaging systems to be integrated into everything from wearable devices to distributed IoT sensors. This shift will be accompanied by the rise of hybrid optical-electronic chips where photonic circuits and traditional silicon electronics coexist on the same substrate, dramatically improving bandwidth and energy efficiency for applications ranging from data communications to portable spectroscopy.

Quantum optical technologies will transition from laboratory curiosities to practical implementations, revolutionizing measurement precision and security. Quantum-enhanced imaging systems will achieve sensitivity beyond classical limits, enabling low-light applications from night vision to deep-space astronomy. Quantum key distribution networks will leverage the fundamental properties of photons to create theoretically unhackable communication channels, while quantum radar and lidar systems may overcome traditional resolution and interference limitations. These developments will be supported by new generations of single-photon detectors and entangled photon sources that operate at practical temperatures and scales.

Sustainability will become a central focus in optical system design, driving innovations in energy-efficient photonics and recyclable materials. Solar-powered optical sensors with near-zero standby power consumption will enable permanent environmental monitoring installations, while biodegradable optical components may be developed for temporary medical implants or ecological sensors. The push for sustainability will also accelerate the development of optical alternatives to energy-intensive technologies, such as optical computing for data centers and optical sensing replacing chemical analysis in industrial processes.

Perhaps most transformative will be the democratization of advanced optical technologies through cost reduction and standardization. Just as camera modules became ubiquitous in consumer electronics, sophisticated optical sensors and imaging systems will become affordable commodities,

enabling widespread deployment in agriculture, infrastructure monitoring, and personal health devices. Cloud-based optical processing and shared satellite constellation data will give even small organizations access to capabilities that were once the exclusive domain of governments and large corporations.

As these trends converge, they promise to create optical systems that are simultaneously more powerful, more compact, more intelligent, and more integrated into our daily lives than ever before. The coming generation of optical technologies won't just improve upon current capabilities—they will enable entirely new ways of seeing, measuring, and interacting with our world, from the quantum scale to interplanetary distances. In this rapidly evolving landscape, optical systems are poised to become even more fundamental to technological progress, serving as the eyes and nervous system of our increasingly data-driven civilization.

32. Look through the text and say what it is about. Give its brief contents.

The Art and Science of Lens Production: Precision Crafting Optical Components

The manufacturing of optical lenses represents a fascinating intersection of materials science, precision engineering, and artisanal craftsmanship. This meticulous process transforms raw glass into high-performance optical elements that power everything from smartphone cameras to advanced microscope objectives and space telescope optics. Each stage of production demands exacting standards to achieve the required optical clarity, surface accuracy, and dimensional stability that define quality in optical systems.

Lens production begins with the careful selection of optical glass, where material properties such as refractive index, dispersion characteristics, and thermal stability are matched to the lens's intended application. Specialized glass formulations may include additives to control color transmission or radiation hardness for space applications. The raw glass arrives as precision-cut blanks or molded preforms, their dimensions slightly larger than the final lens to allow for machining tolerances. Modern facilities often employ automated inventory systems that track each glass blank's material properties and lot history throughout the production lifecycle.

The shaping process starts with rough grinding, where diamond-impregnated tools remove bulk material to establish the lens's basic curvature. This initial forming operation brings the blank within hundreds of microns of its final dimensions. Subsequent fine grinding stages progressively refine the surface using successively smaller abrasive particles, achieving micrometer-level accuracy in surface profile. Throughout these operations, computer-controlled machining centers maintain tight tolerances on center thickness and diameter while ensuring the optical axis remains perfectly aligned with mechanical references. Coolant systems play a critical role during grinding, both to remove heat and to flush away glass particles that could scratch delicate surfaces.

Polishing transforms the ground lens into an optically smooth surface, typically requiring multiple steps with increasingly fine polishing compounds. Traditional pitch polishing methods, where the lens is worked against a precisely shaped pitch lap, coexist with modern computer-controlled polishing systems that can adapt their motion patterns to correct detected surface irregularities. Advanced facilities employ in-process metrology tools that measure surface figures in real time, allowing immediate corrections before the lens moves to the next production stage. The polishing process continues until the surface achieves a roughness measured in angstroms—so smooth that any residual irregularities are smaller than the wavelength of visible light.

Centration and edging operations ensure the lens's optical surfaces are perfectly aligned about its mechanical axis. Precision spindles rotate the lens while optical indicators measure runout, guiding the machining of the outer diameter until all surfaces are concentric within micron-level tolerances. This step proves particularly crucial for multi-element lens assemblies where even slight decentration can degrade optical performance. Modern edging machines often incorporate vision systems that automatically detect and align to optical features rather than mechanical references alone.

Many lenses then undergo specialized coating processes to enhance their optical performance. Vacuum deposition chambers apply multilayer dielectric coatings that control reflection characteristics across specific wavelength ranges. Anti-reflective coatings for camera lenses might consist of a dozen or more carefully controlled layers, each just molecules thick, designed to minimize reflections across the visible spectrum. Other specialized coatings provide water

repellency, scratch resistance, or spectral filtering properties tailored to the lens's application.
Quality assurance represents the final and perhaps most critical phase of lens production. Interferometers measure surface figures to nanometer accuracy, verifying conformity to design specifications across the entire aperture. Transmission and wavefront error tests confirm optical performance, while environmental testing subjects samples to thermal cycling and humidity exposure to ensure long-term stability. Only lenses passing all stringent inspections proceed to final cleaning and packaging, often in cleanroom environments to prevent particulate contamination.
As lens technology advances, production methods continue evolving. Freeform optics manufacturing enables complex aspheric surfaces that reduce system size and improve performance. Magnetorheological finishing techniques allow deterministic correction of nanometer-scale surface errors. Additive manufacturing methods are being explored for rapid prototyping of novel optical geometries. Yet despite these technological advances, lens manufacturing remains fundamentally rooted in the precise control of light's interaction with matter—a process that continues to challenge and inspire optical engineers in equal measure. The resulting components stand as testaments to human ingenuity, enabling us to extend our vision from the microscopic to the cosmic.

33. Translate the text (1800 printed characters; time – 60 min.)

The Critical Role of Optoelectronic Systems in Modern Remote Sensing Technologies

Remote sensing has revolutionized our ability to monitor and analyze Earth's surface, atmosphere, and oceans from airborne and spaceborne platforms. At the heart of these capabilities lie advanced optoelectronic systems – sophisticated instruments that capture, process, and interpret electromagnetic radiation across various spectral bands. These systems have become indispensable tools for scientific research, environmental monitoring, defense applications, and commercial earth observation.
The fundamental principle behind optoelectronic remote sensing involves the detection of reflected or emitted electromagnetic energy from terrestrial features. Modern systems operate across multiple spectral regions – from visible light and near-infrared to thermal and microwave wavelengths – each providing unique information about observed phenomena. Optical sensors, particularly those using charge-coupled device (CCD) and complementary metal-oxide-semiconductor (CMOS) technologies, form the backbone of high-resolution imaging systems. These detectors convert photons into electrical signals with remarkable precision, enabling the creation of detailed multispectral and panchromatic images with spatial resolutions now reaching submeter levels from satellite platforms.
Hyperspectral imaging represents one of the most significant advancements in optoelectronic remote sensing. Unlike conventional multispectral systems that capture data in several broad spectral bands, hyperspectral sensors record information in hundreds of contiguous narrow bands, effectively creating a continuous spectral signature for each pixel in an image. This capability allows for unprecedented material discrimination and identification, finding applications in mineral exploration, precision agriculture, and environmental monitoring. The development of compact, high-throughput spectrometers has made this technology increasingly accessible for both spaceborne and unmanned aerial vehicle (UAV) platforms.

Thermal infrared optoelectronic systems provide another critical capability by detecting emitted rather than reflected radiation. These sensors measure surface temperature variations with high accuracy, enabling applications ranging from volcanic activity monitoring to urban heat island studies. Recent advances in uncooled microbolometer arrays have significantly reduced the size, weight, and power requirements of thermal imaging systems, facilitating their deployment on smaller satellite platforms.

Active optoelectronic systems, particularly light detection and ranging (LiDAR) instruments, have transformed our ability to perform precise topographic mapping and vegetation structure analysis. By emitting laser pulses and measuring their return time, these systems generate highly accurate three-dimensional representations of Earth's surface. Modern photon-counting LiDAR systems can even detect single photons, enabling vegetation penetration and detailed terrain mapping under canopy cover. The miniaturization of laser systems and improvements in detector sensitivity continue to expand the applications of this technology.

34. Translate the text (1800 printed characters; time – 60 min.)

The integration of optoelectronic systems with advanced data processing techniques represents another frontier in remote sensing. Artificial intelligence and machine learning algorithms now enable near-real-time analysis of optical data streams, automating tasks such as change detection, object recognition, and anomaly identification. These capabilities are particularly valuable for applications requiring rapid response, such as disaster monitoring or military surveillance.

Despite these advancements, optoelectronic remote sensing systems face several technical challenges. Atmospheric interference, particularly from clouds and aerosols, can significantly degrade optical measurements. The development of adaptive optics and advanced atmospheric correction algorithms has helped mitigate these effects, but all-weather capability remains a limitation compared to microwave systems. Additionally, the growing demand for higher spatial, spectral, and temporal resolutions drives continuous innovation in detector technology, with quantum dot and superconducting detectors emerging as promising future technologies.

The commercial sector has become a major driver of optoelectronic remote sensing innovation, with private companies deploying constellations of small satellites carrying advanced optical payloads. These systems provide frequent revisit times and customized data products, serving markets ranging from agriculture to urban planning. Meanwhile, government agencies continue to push the boundaries of optoelectronic technology with missions designed for climate monitoring, national security, and scientific discovery.

As we look to the future, optoelectronic systems will remain central to remote sensing capabilities, with emerging technologies like quantum imaging and optical phased arrays poised to unlock new observational possibilities. The ongoing convergence of optical, computational, and communication technologies promises to further enhance our ability to monitor and understand our planet, ensuring that optoelectronic systems continue to play a vital role in addressing global challenges related to climate change, resource management, and environmental protection.

The evolution of these systems reflects a broader trend in remote sensing – the transition from simple data collection to sophisticated information extraction systems that provide actionable intelligence. As sensor technologies continue to advance and data processing capabilities grow, optoelectronic systems will undoubtedly remain at the forefront of Earth observation, providing critical insights into our changing planet. Their role in shaping our understanding of Earth systems and informing decision-making processes across numerous sectors cannot be overstated, making them one of the most valuable tools in modern geospatial science and applications.

35. Translate the text (1800 printed characters; time – 60 min.)

The Fundamental Principle Behind Optoelectronic Remote Sensing

At its core, optoelectronic remote sensing operates on the fundamental interaction between electromagnetic radiation and matter. This technology harnesses the principles of optics and electronics to detect, measure, and analyze energy patterns reflected or emitted from the Earth's surface and atmosphere. The complete process involves a sophisticated chain of energy transformations, beginning with solar illumination or active energy emission and culminating in meaningful geospatial data products.

The process initiates when a target surface interacts with electromagnetic energy, either from natural sources like the sun or artificial sources such as laser systems. This interaction follows well-defined physical principles where different materials selectively absorb, reflect, or emit radiation according to their molecular composition and surface characteristics. Vegetation, for instance, strongly reflects near-infrared radiation while absorbing visible red light, creating distinct spectral signatures that enable vegetation health assessment. Water bodies, conversely, absorb most infrared radiation while reflecting blue-green wavelengths, producing their characteristic appearance in optical imagery.

Optoelectronic sensors capture these interactions through precision-engineered detectors that convert photon energy into electrical signals. Modern systems employ various detector technologies, with charge-coupled devices (CCDs) and complementary metal-oxide-semiconductor (CMOS) sensors being most prevalent for visible and near-infrared ranges. These detectors consist of millions of light-sensitive elements that record the intensity of radiation across specific wavelength bands. The quantum efficiency of these detectors - their ability to convert incident photons into measurable electrons - fundamentally determines system sensitivity and performance.

Spectral separation represents another critical aspect of the principle, achieved through optical filters, diffraction gratings, or interferometric techniques. Multispectral systems typically employ discrete

bandpass filters to isolate specific wavelength ranges, while hyperspectral instruments use more sophisticated dispersion elements to achieve continuous spectral sampling. This spectral discrimination enables the identification of materials through their characteristic reflectance or emission patterns, forming the basis for numerous remote sensing applications from mineral exploration to pollution monitoring.

36. Translate the text (1800 printed characters; time – 60 min.)

The spatial resolution capability derives from optical system design and detector characteristics, governed by the Rayleigh criterion and sensor altitude. Higher resolution requires larger aperture optics and smaller detector elements, presenting engineering challenges in balancing performance with practical constraints like size, weight, and power requirements. Modern pushbroom imaging systems, where linear detector arrays capture entire image lines as the platform moves, have largely replaced older whiskbroom designs, offering improved sensitivity and geometric accuracy.

Radiometric calibration forms an essential component of the fundamental principle, ensuring that measured signals accurately represent actual radiation values. This involves meticulous characterization of detector response across all operational conditions, accounting for factors like temperature variations and detector aging. Absolute calibration references these measurements to standardized physical units, enabling quantitative analysis and comparison between different sensors and observation dates.

The complete remote sensing chain also incorporates atmospheric compensation, as Earth's atmosphere modifies radiation through scattering and absorption processes. Rayleigh scattering affects shorter wavelengths, explaining the blue sky phenomenon, while aerosol scattering impacts visibility conditions. Water vapor and other atmospheric constituents create absorption bands that must be accounted for in accurate surface reflectance retrieval. Advanced atmospheric correction algorithms now routinely remove these effects, significantly improving data quality for quantitative applications.

Temporal resolution represents another fundamental consideration, determined by sensor revisit capability and orbital characteristics. Sun-synchronous polar orbits provide consistent illumination conditions for optical systems, while geostationary platforms offer continuous monitoring of specific regions. The growing constellation of small satellites has dramatically improved temporal resolution, enabling daily or even more frequent observations for many parts of the Earth.

These fundamental principles combine to create powerful Earth observation capabilities that support diverse applications ranging from precision agriculture to climate change research. The continuous advancement of optoelectronic technologies promises even greater capabilities, with emerging detector materials, miniaturized optical systems, and advanced data processing techniques pushing the boundaries of what remote sensing can achieve. Understanding these core principles provides the foundation for developing new applications and interpreting the wealth of information contained in every remote sensing dataset.

37. Translate the text (1800 printed characters; time – 60 min.)

Optoelectronic Systems: Definition and Functional Principles

Optoelectronic systems represent a specialized class of technology that bridges the domains of optics and electronics, combining light-based phenomena with electronic signal processing. These systems fundamentally involve the conversion of light energy into electrical signals or vice versa, enabling a wide range of detection, measurement, and communication applications. At their core, optoelectronic devices manipulate photons to perform functions that would be impossible with purely electronic or purely optical systems alone.

The functional architecture of optoelectronic systems typically consists of three key components: an optical input stage, an electronic processing unit, and an output interface that may be either optical or electronic. The optical input stage gathers and focuses electromagnetic radiation using lenses, mirrors, or optical fibers, while specialized photodetectors convert this optical information into electrical signals. The electronic processing unit then amplifies, filters, and analyzes these signals, with the processed information either displayed through electronic means or reconverted into optical outputs through light-emitting components.

These systems perform several critical functions across various technological domains. In sensing applications, they detect and quantify light properties including intensity, wavelength, polarization,

and phase differences with extraordinary precision. Imaging systems leverage optoelectronic principles to capture spatial light distributions and convert them into digital representations, forming the basis for modern digital cameras, medical imaging devices, and remote sensing equipment. For communication purposes, optoelectronic components enable high-speed data transmission through fiber-optic networks, where electrical signals modulate laser light that travels through optical fibers before being converted back to electrical form at the receiving end.

Optoelectronic systems also serve vital functions in industrial control and automation, where they provide non-contact measurement solutions for parameters like distance, thickness, and surface quality. Laser-based systems perform precise material processing tasks including cutting, welding, and engraving, while light barriers and optical encoders ensure accurate position sensing in manufacturing environments. In consumer electronics, optoelectronic components form the backbone of display technologies, optical storage systems, and user interface devices like touchscreens and gesture recognition systems.

The unique advantage of optoelectronic systems lies in their ability to perform measurements without physical contact, their immunity to electromagnetic interference, and their capacity for extremely high-speed operation. These characteristics make them indispensable in applications ranging from scientific research and medical diagnostics to telecommunications and environmental monitoring. As technology advances, optoelectronic systems continue to evolve, incorporating nanomaterials, quantum effects, and integrated photonic circuits to achieve ever-higher performance levels across all their functional applications.

38. Translate the text (1800 printed characters; time – 60 min.)

Components of Optoelectronic Systems: The Optical Input Unit

At the heart of every optoelectronic system lies the optical input unit, a sophisticated assembly that serves as the gateway for light to enter and interact with the system. This critical first stage determines the quality, fidelity, and reliability of all subsequent processing, making its design fundamental to overall system performance. The optical input unit performs three primary functions: light collection, spectral conditioning, and initial photon-to-electron conversion, each implemented through specialized components working in precise harmony.

The light collection subsystem begins with the objective optics, typically comprising precisely ground lenses or curved mirrors that gather incoming photons and focus them onto the detection plane. These optical elements must maintain exceptional surface quality, with tolerances often measured in fractions of a wavelength, to minimize aberrations that could distort the incoming signal. In imaging applications, the objective lens assembly creates a faithful reproduction of the scene at the focal plane, while in spectroscopic systems, it efficiently couples light into the spectral separation components. Modern systems increasingly employ aspheric and diffractive optical elements to reduce weight and correct aberrations more effectively than traditional spherical lenses.

Following initial light collection, the spectral conditioning module tailors the electromagnetic input to match the system's measurement requirements. This may involve narrowband interference filters that transmit only specific wavelengths, tunable acousto-optic filters for programmable band selection, or fully dispersive elements like diffraction gratings in spectroscopic applications. The spectral conditioning stage often includes mechanisms for polarization control, using waveplates or polarizing beam splitters when the polarization state carries relevant information. Advanced systems incorporate adaptive optics that dynamically compensate for atmospheric distortions or platform-induced image degradation, particularly in aerospace and astronomical applications.

39. Translate the text (1800 printed characters; time – 60 min.)

The photodetection array represents the final and most critical element of the optical input unit, where photons undergo transformation into measurable electrical signals. Modern systems employ various detector technologies selected based on wavelength sensitivity, response speed, and noise characteristics. Silicon-based charge-coupled devices (CCDs) dominate visible light applications with their excellent linearity and uniform response, while indium gallium arsenide (InGaAs) detectors extend sensitivity into the near-infrared. Emerging materials like mercury cadmium telluride (MCT) push detection further into the infrared spectrum for thermal imaging applications. Each detector pixel acts as a tiny photon counter, with its semiconductor structure engineered to maximize quantum efficiency - the probability that an incident photon will generate a measurable

electron-hole pair.
Supporting these primary components, the optical input unit incorporates several ancillary systems that ensure optimal operation. Precision mechanical mounts maintain alignment under thermal and vibrational stresses, while thermoelectric coolers stabilize detector temperatures to reduce dark current in sensitive applications. Anti-reflection coatings on optical surfaces minimize light loss at each interface, and carefully designed baffling prevents stray light from contaminating the desired signal. In active sensing systems that employ their own light sources like LIDAR, the input unit includes sophisticated timing circuitry to correlate outgoing pulses with returning echoes at nanosecond precision.
The optical input unit's performance directly determines the system's fundamental capabilities - its spatial resolution depends on optical quality and detector pitch, spectral resolution on the conditioning components, and sensitivity on detector quantum efficiency and noise characteristics. As optoelectronic systems push toward higher performance across all these parameters, the optical input unit continues to evolve, incorporating nanophotonic elements, metasurfaces, and quantum-enhanced detection schemes that promise to redefine what's possible in light detection and measurement.

40. Translate the text (1800 printed characters; time – 60 min.)

Optical Sensors: Principles and Applications

Optical sensors represent a critical class of devices that convert light characteristics into measurable electrical signals, enabling precise detection and analysis across numerous scientific, industrial, and consumer applications. These sensors operate on fundamental optoelectronic principles, where incident photons interact with specialized materials to produce quantifiable responses that reveal information about the light source, the transmission medium, or illuminated objects.
The working mechanism of optical sensors begins with photon absorption in semiconductor materials, where incoming light excites electrons across the material's bandgap, generating charge carriers proportional to the light intensity. Different semiconductor compounds enable sensitivity across specific spectral ranges - silicon detectors excel in visible wavelengths (400-1100 nm), while indium gallium arsenide (InGaAs) covers near-infrared (900-1700 nm), and mercury cadmium telluride (MCT) extends into mid-wave and long-wave infrared regions. Advanced sensor designs incorporate multiple detection layers or quantum dot structures to achieve broadband spectral response from ultraviolet to far-infrared wavelengths.
Modern optical sensors demonstrate remarkable performance characteristics through innovative architectures. CMOS image sensors integrate amplification and digitization circuits directly with each photodiode, enabling high-speed readout and improved signal-to-noise ratios. Time-of-flight sensors precisely measure light travel time for distance mapping applications, while single-photon avalanche diodes (SPADs) achieve unprecedented sensitivity for low-light scientific and medical imaging. Interferometric sensors exploit wave nature of light to measure displacements with nanometer precision, and hyperspectral sensors employ tunable filters or dispersive elements to resolve hundreds of narrow spectral bands simultaneously.
The applications of optical sensors span diverse industries with stringent performance requirements. In industrial automation, diffuse reflection sensors detect object presence without physical contact, while laser triangulation sensors measure dimensional parameters with micron-level accuracy. Environmental monitoring relies on spectroscopic sensors for air and water quality analysis, detecting molecular absorption fingerprints across specific wavelengths. Biomedical applications utilize optical sensors for pulse oximetry, glucose monitoring, and DNA sequencing through fluorescence detection. Autonomous vehicles integrate LiDAR sensors with high-power lasers and sensitive detectors for real-time 3D environment mapping, while smartphone cameras employ increasingly sophisticated multi-pixel sensors with phase-detection autofocus and high dynamic range capabilities.
Ongoing advancements continue pushing optical sensor capabilities through novel materials and architectures. Quantum dot sensors enhance color purity and sensitivity, organic photodetectors enable flexible and large-area sensing surfaces, and metasurface optics allow unprecedented miniaturization of spectral sensors. Neuromorphic vision sensors mimic biological retina operation for efficient event-based imaging, and integrated photonic circuits combine multiple optical

functions on single chips. These developments ensure optical sensors will remain indispensable tools for scientific discovery, industrial innovation, and technological progress across all light-based measurement applications.

41. Translate the text (1800 printed characters; time – 60 min.)

Hyperspectral Imaging: Capturing the Invisible Spectrum

Hyperspectral imaging represents a transformative advancement in optical sensing, enabling the capture and analysis of materials based on their unique spectral fingerprints. Unlike conventional imaging systems that record only a few broad spectral bands, hyperspectral sensors divide the electromagnetic spectrum into hundreds of narrow, contiguous channels, creating a detailed reflectance profile for every pixel in a scene. This rich spectral data unlocks the ability to identify and distinguish materials with unprecedented accuracy, even when they appear visually identical to the human eye or traditional cameras.

The foundation of hyperspectral imaging lies in its ability to measure how different materials interact with light at specific wavelengths. Every substance reflects, absorbs, and emits electromagnetic radiation in characteristic patterns dictated by its molecular composition. Vegetation, for example, exhibits strong reflectance in the near-infrared due to chlorophyll activity, while minerals display distinct absorption features in the short-wave infrared. Hyperspectral sensors detect these subtle variations across the spectrum, transforming them into high-dimensional data cubes that contain both spatial and spectral information.

Two primary architectures enable hyperspectral data acquisition: push-broom and snapshot systems. Push-broom sensors, commonly used in airborne and spaceborne platforms, employ a slit aperture and dispersive element to scan across a scene line by line, building up spectral profiles for each spatial pixel. This method provides high spectral fidelity but requires precise motion compensation. Snapshot hyperspectral cameras, on the other hand, capture the entire spectral and spatial information in a single exposure using advanced optical designs like image slicers or Fabry-Pérot filters. While offering real-time operation, these systems often trade off some spectral resolution for increased speed and simplicity.

The applications of hyperspectral imaging span a diverse range of fields, each benefiting from its ability to reveal hidden chemical and physical properties. In precision agriculture, hyperspectral data identifies crop stress before visible symptoms emerge, allowing targeted irrigation and fertilization. Environmental scientists use it to monitor water quality, detect oil spills, and map invasive species. The mining industry relies on hyperspectral analysis for mineral exploration, distinguishing ore types that would otherwise require laboratory testing. Medical researchers are exploring its potential for non-invasive diagnostics, where subtle spectral changes in tissue can indicate disease states. Even art conservation benefits, as hyperspectral imaging uncovers underlying sketches and pigment compositions invisible under normal light.

42. Translate the text (1800 printed characters; time – 60 min.)

Hyperspectral imaging represents a transformative advancement in optical sensing, enabling the capture and analysis of materials based on their unique spectral fingerprints. Unlike conventional imaging systems that record only a few broad spectral bands, hyperspectral sensors divide the electromagnetic spectrum into hundreds of narrow, contiguous channels, creating a detailed reflectance profile for every pixel in a scene.

Processing hyperspectral data presents unique computational challenges due to its high dimensionality. Advanced machine learning algorithms, including deep neural networks, have become essential for extracting meaningful information from these massive datasets. Techniques like spectral unmixing separate overlapping signatures from mixed pixels, while anomaly detection identifies rare or unexpected materials within a scene. The fusion of hyperspectral data with LiDAR or thermal imaging further enhances analytical capabilities, creating multi-modal sensing systems for comprehensive environmental monitoring.

Despite its power, hyperspectral imaging faces practical limitations in cost, data volume, and processing requirements. However, ongoing advancements in sensor miniaturization, computational optics, and edge processing are making the technology more accessible. Emerging developments in quantum dot filters and metasurface optics promise to reduce the size and complexity of hyperspectral systems, while new compression algorithms ease data storage and transmission

burdens. As these innovations progress, hyperspectral imaging is poised to transition from specialized applications to broader adoption in industrial inspection, consumer devices, and real-time monitoring systems.

The true value of hyperspectral imaging lies in its ability to convert invisible spectral variations into actionable knowledge. By revealing the chemical composition of objects and environments at a distance, it provides insights that were previously impossible without physical sampling. As sensor technology and data analytics continue to evolve, hyperspectral imaging will play an increasingly vital role in scientific discovery, industrial optimization, and our understanding of the natural world.

43. Translate the text (1800 printed characters; time – 60 min.)

Synthetic Aperture Radar (SAR): Seeing Through Darkness and Clouds

Synthetic Aperture Radar represents one of the most powerful remote sensing technologies, capable of capturing high-resolution images of Earth's surface regardless of daylight conditions or weather. Unlike optical systems that rely on sunlight, SAR actively illuminates its target with microwave radiation and analyzes the reflected signals to construct detailed images. This unique capability enables continuous Earth observation through cloud cover, smoke, and even darkness, making it indispensable for applications ranging from disaster monitoring to military reconnaissance.

The fundamental principle of SAR involves the precise measurement of microwave echoes as the radar platform moves along its flight path. By combining signals received at multiple positions, the system synthesizes an effectively much larger antenna, hence the "synthetic aperture" name. This approach achieves remarkable spatial resolution that would otherwise require impractical physical antenna sizes. Modern SAR systems operate across various frequency bands, from P-band (30-100 cm wavelength) for vegetation penetration to X-band (2.5-4 cm) for high-resolution imaging, each offering different capabilities for surface characterization.

SAR's all-weather capability stems from microwave radiation's ability to penetrate most atmospheric obstructions. While clouds and rain do affect the signal, particularly at higher frequencies, SAR continues functioning where optical sensors fail. This reliability proves critical for monitoring natural disasters like tropical cyclones or volcanic eruptions that typically occur under poor weather conditions. The technology's sensitivity to surface texture and dielectric properties also enables detection of subtle changes invisible to optical sensors, such as soil moisture variations or underground structures.

Advanced SAR techniques expand the technology's applications beyond simple imaging. Interferometric SAR (InSAR) compares phase differences between multiple acquisitions to measure surface deformations with millimeter precision, revolutionizing earthquake and subsidence monitoring. Polarimetric SAR analyzes how targets alter the polarization state of reflected waves, providing information about material properties and structural orientation. Tomographic SAR extends this concept into three dimensions, enabling vertical structure mapping in forests and urban areas.

The military and intelligence communities were early adopters of SAR technology due to its day-night operation and ability to detect man-made objects obscured by camouflage. Civilian applications have since grown to encompass numerous fields: oil spill detection through characteristic surface damping of ocean waves, illegal logging monitoring in tropical forests, and even archaeology for discovering buried ruins. Recent miniaturization efforts have made SAR technology accessible for small satellites and unmanned aerial vehicles, enabling more frequent revisits and lower-cost operations.

Despite its advantages, SAR interpretation presents unique challenges. The side-looking geometry creates geometric distortions like layover and shadow effects in mountainous terrain. Speckle noise inherent in coherent imaging requires sophisticated filtering techniques. Additionally, SAR data products often demand specialized processing to convert raw radar returns into meaningful information, though machine learning approaches are increasingly automating this task.

Future SAR developments focus on improving temporal resolution through satellite constellations, enhancing resolution with advanced processing algorithms, and integrating artificial intelligence for automatic target recognition. The emergence of digital beamforming technologies allows for more flexible operation modes, while quantum radar concepts promise further sensitivity improvements. As these innovations mature, SAR will continue expanding its role as a critical Earth observation

tool, providing reliable data when and where other sensing modalities cannot operate.

44. Translate the text (1800 printed characters; time – 60 min.)

Development Prospects of Optical Systems

The field of optical systems, which integrates optics and electronics, is experiencing rapid growth due to advancements in photonics, telecommunications, and automation. The development prospects of optical systems are highly promising, driven by increasing demand in various industries, including healthcare, defense, consumer electronics, and industrial automation.

One of the key growth areas is in high-speed data transmission. With the expansion of 5G networks and the need for faster internet connectivity, optical systems—particularly fiber-optic communication—are becoming essential. The shift toward optical interconnects in data centers and telecommunication infrastructure ensures sustained demand for optoelectronic components such as lasers, photodetectors, and optical modulators.

Another significant opportunity lies in medical and biotechnological applications. Optical systems are widely used in imaging technologies, laser surgery, and diagnostic equipment. As minimally invasive procedures and precision medicine gain traction, the need for advanced optical sensors and imaging systems will continue to rise.

Automation and Industry 4.0 are also driving the adoption of optical systems. LiDAR (Light Detection and Ranging) technology, optical sensors, and machine vision systems play a crucial role in autonomous vehicles, robotics, and smart manufacturing. The increasing integration of AI with optical systems further enhances their capabilities, making them indispensable in modern industrial processes.

Moreover, defense and aerospace sectors rely heavily on optical systems for surveillance, targeting, and secure communication. Infrared imaging, laser-based guidance systems, and optoelectronic countermeasures are critical for modern military applications, ensuring steady investment in research and development.

Despite these opportunities, challenges such as high production costs and the need for specialized materials remain. However, ongoing research in nanophotonics, quantum optics, and integrated photonics is expected to overcome these barriers, opening new possibilities for compact, efficient, and cost-effective optical systems.

In conclusion, the future of optical systems is bright, with expanding applications across multiple high-tech industries. Continuous innovation, coupled with growing demand for high-performance optical solutions, ensures that optical systems will remain a cornerstone of technological progress in the coming decades.

45. Translate the text (1800 printed characters; time – 60 min.)

Optical Sensors and Arrays

Optical sensors and detector arrays are critical components in modern technology, enabling precise measurement, imaging, and data acquisition across various industries. These devices convert light signals into electrical signals, allowing for applications in consumer electronics, industrial automation, medical diagnostics, and defense systems.

One of the most widespread uses of optical sensors is in digital imaging. CMOS and CCD (Charge-Coupled Device) sensor arrays are fundamental to cameras, smartphones, and medical imaging equipment. Advances in pixel density, low-light sensitivity, and dynamic range continue to enhance image quality, enabling high-resolution photography, videography, and machine vision applications.

In industrial automation, optical sensors play a vital role in quality control, object detection, and alignment systems. Photoelectric sensors, for instance, are used for precise positioning in manufacturing lines, while infrared sensors enable non-contact temperature measurement and gas detection. Time-of-flight (ToF) sensors improve depth perception in robotics and autonomous systems, contributing to smarter and more efficient industrial processes.

Medical applications benefit significantly from optical sensor technology. Pulse oximeters use light absorption to measure blood oxygen levels, while endoscopic cameras rely on compact sensor arrays

for minimally invasive procedures. Emerging biosensors leverage optical principles for real-time disease detection, enhancing diagnostic accuracy and patient care.

Defense and aerospace industries utilize optical sensor arrays for surveillance, targeting, and environmental monitoring. Infrared sensors enable night vision and thermal imaging, while hyperspectral imaging systems provide detailed spectral analysis for reconnaissance and remote sensing.

Despite their advantages, challenges such as signal noise, power consumption, and environmental interference persist. However, ongoing advancements in nanomaterials, quantum dots, and AI-driven signal processing are expected to improve sensor performance, making them even more versatile and reliable.

In summary, optical sensors and arrays are indispensable in today's technology-driven world. Their continuous evolution ensures broader adoption in emerging fields, reinforcing their role in innovation and automation.

46. Answer the question:

Who proposed the atomic structure theory of light emission? How many models of this phenomenon are known?

47. Answer the question:

Which optical systems are you familiar with?

48. Answer the question:

Where are optical systems commonly used?

49. Answer the question:

Are optical systems employed in remote sensing? If so, how?

50. Answer the question:

What are the three most critical components of a remote sensing optical system?

51. Answer the question:

Which categories of optical systems do you recognize?

52. Answer the question:

What role do materials play in the performance of optical system lenses?

53. Answer the question:

What is the most important characteristic of any optical system?

54. Answer the question:

How would you decipher abbreviation SAR?

55. Answer the question:

Where is artificial intelligence (AI) applied in optical systems?

56. Answer the question:

What is the significance of miniaturization in optical systems?

57. Answer the question:

Can optical systems aid in anti-poaching efforts?

58. Answer the question:

What factors determine the spatial resolution capabilities of an optical system?

59. Answer the question:

Is it possible to identify materials based on their spectral fingerprints?

60. Answer the question:

What functions do optical sensors perform?