Міністерство освіти і науки України
НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
«ОДЕСЬКА ПОЛІТЕХНІКА»

ПРОФЕСІЙНА ІНОЗЕМНА МОВА

Методичні вказівки
до практичних занять з англійської мови
«Практика опанування термінологічною лексикою за фахом»
для здобувачів вищої освіти і здобувачів PhD
Інституту медичної інженерії (IMI)
спеціальності: 163 Біомедична інженерія

Одеса НУОП – 2023

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Затверджено
на засіданні кафедри
іноземних мов
Протокол № 5 від 06.02.2023р.

Одеса НУОП – 2023

Методичні вказівки до практичних занять з англійської мови «Практика опанування термінологічною лексикою за фахом» для здобувачів вищої освіти і здобувачів PhD Інституту медичної інженерії (IMI) спеціальності: 163 Біомедична інженерія/ Уклад.Г.Ф. Дьяченко, М.Г. Томенко - Одеса: НУОП, 2023. - 28 с.

Укладачі: Г.Ф. Дьяченко, канд. філол. наук, доц.

М.Г. Томенко, ст.викладач

ЗМІСТ

ПЕРЕДМОВА

Дане видання являє собою систему навчальних тестів по розділах курсу сучасної англійської мови для спеціальних цілей (English for Specific Purposes - ESP) в процесі самостійної роботи студентів.

Система навчальних тестів націлена на подолання лексико-граматичних труднощів читання текстів, що відносяться до конкретної професійної діяльності. Терміни переведені з / на англійську мову в можливих варіантах їх вживання в професійній сфері, що забезпечить зручність роботи з іноземними базами даних.

Тести призначені для студентів денної та заочної форм навчання і можуть використовуватися як засіб самонавчання та самоконтролю при підготовці до іспитів і заліків; для аспірантів та наукових співробітників.

Тести навчають читати науково-технічну інформацію і розуміти, як англійська мова функціонує в професійній ситуації, навчають пошуку інформації в професійній області знань.

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Reading and Comprehension Tests

I.

1. Read:

Basics and Definition of Metrology. Categories of Metrology

Metrology comes from the Greek word “metron" and “logos" which literally means the study of measurement. This study covers both the experimental and theoretical aspects of measurement and the determination of the levels of uncertainty of these aspects. The study of measurement is a basic requirement in any field of science and technology, most essential in engineering and manufacturing. The knowledge about anything is complete only when it can be expressed in numbers and something is known about it. Thus for every kind of quantity measured, there must be a unit to measure it and express it in numbers of that unit. In metrology, we have to go one step ahead and see for the correctness of measurement also. We have to see whether the result is given with the sufficient correctness and accuracy for the particular need or not. Metrology is also concerned with the methods, execution and estimation of accuracy of measurements; the measuring instruments and the inspectors.

2. Summarize!

Put the parts in order to form a sentence:

engineering and manufacturing. in any field of science and technology, is a basic requirement most essential in The study of measurement

II.

Metrology and biomedicine. Application of biomedical metrotomography

1. Read:

Computed tomography scanners (or CT scanners) are very popular medical equipments for tens of years. Its invention initiated a revolution in diagnostic technology by allowing us to look inside a person and obtain a very clear anatomical image without violating the outer surface of his body, in other words, non-invasively. Just a few years ago this technology found way to the area of industrial applications and especially to geometrical metrology. Metrotomography is a term that consists of words metrology and tomography. Specific prosthetic and biomedical experiments were realized by Metrotom 1500 (Carl Zeiss, Germany) at the Technology center of computed tomography, Department of Biomedical Engineering, Automation and Measurement, Technical University in Kosice. Today industrial CT is on its way to become a major tool of industrial quality control in high-tech branches, not only for material testing but for geometry analysis as well.

2. Summarize!

Put the parts in order to form a sentence:

a revolution in allowing us CT scanner invention initiated diagnostic technology by to look inside a person.

III.

Introduction to Engineering Mechanics

1. Read:

The state of rest and state of motion of the bodies under the action of different forces has engaged the attention of philosophers, mathematicians and scientists for many centuries. The branch of physical science that deals with the state of rest or the state of motion is termed as Mechanics. Starting from the analysis of rigid bodies under gravitational force and simple applied forces the mechanics has grown to the analysis of robotics, aircrafts, space crafts under dynamic forces, atmospheric forces, temperature forces etc. Sir Isaac Newton, the principal architect of mechanics, consolidated the philosophy and experimental findings developed around the state of rest and state of motion of the bodies and put forth them in the form of three laws of motion as well as the law of gravitation. The mechanics based on these laws is called Classical mechanics or Newtonian mechanics. Albert Einstein proved that Newtonian mechanics fails to explain the behavior of high speed (speed of light) bodies. He put forth the theory of Relativistic Mechanics.

2. Summarize!

Put the parts in order to form a sentence:

deals with the state of rest or is termed as Mechanics. The branch of physical science that the state of motion

IV.

Biophysics. Introduction to neurons and the brain

1. Read:

Biophysics is an interdisciplinary science that applies approaches and methods traditionally used in physics to study biological phenomena. Biophysics covers all scales of biological organization, from molecular to organismic and populations. Biophysical research shares significant overlap with biochemistry, molecular biology, physical chemistry, physiology, nanotechnology, bioengineering, computational biology, biomechanics and systems biology. The term biophysics was originally introduced by Karl Pearson in 1892. Ambiguously, the term biophysics is also regularly used in academia to indicate the study of physical quantities (e.g. electric current, temperature, stress, entropy) in biological systems, which is, by definition, performed by physiology. Nevertheless, other biological sciences also perform research on the biophysical properties of living organisms including molecular biology, cell biology, biophysics and biochemistry. Molecular biophysics typically addresses biological questions similar to those in biochemistry and molecular biology, seeking to findphysical underpinnings of biomolecular phenomena. Scientists in this field conduct research concerned with understanding the interactions between the various systems of a cell, including the interactions between deoxyribonucleic acid(DNA), ribonucleic acid (RNA) and protein biosynthesis, as well as how these interactions are regulated.

2. Summarize!

Put the parts in order to form a sentence:

all scales of biological organization, Biophysics covers from molecular to organismic and populations.

V.

Biochemistry

1. Read:

Biochemistry, sometimes called biological chemistry, is the study of chemical processes within and relating to living organisms. Biochemical processes give rise to the complexity of life. A sub-discipline of both biology and chemistry, biochemistry can be divided in three fields; molecular genetics, protein science and metabolism. Over the last decades of the 20th century, biochemistry has become successful through these three disciplines at explaining living processes. Almost all areas of the life sciences are being uncovered and developed by biochemical methodology and research. Molecular genetics is a branch of genetics dealing with the structure and activity of genetic material at the molecular level.

Proteins are large organic compounds made of amino acids arranged in a linear chain and joined together between the carboxyl atom of one amino acid and the amine nitrogen of another.

2. Summarize!

Put the parts in order to form a sentence:

Almost all areas of are being uncovered and biochemical methodology. developed by the life sciences

VI.

Basic Terminologies in Mechanics

1. Read:

The following are the basic terms to study mechanics, which should be understood clearly: mass, time, space, length, displacement, velocity, acceleration, momentum, continuum, rigid body and particle. **Length.** It is a concept to measure linear distances. **Mass.** The quantity of the matter possessed by a body is called mass. The mass of a body will not change unless the body is damaged and part of it is physically separated. **Time.** Time is the measure of succession of events. The successive event selected is the rotation of earth about its own axis and this is called a day. **Space.** The geometric region in which study of body is involved is called space. **Displacement.** Displacement is defined as the distance moved by a body/particle in the specified direction and others. **Length (L), Mass (M) and Time (T)** are the fundamental units in mechanics. The units of all other quantities may be expressed in terms of these basic units.

2. Summarize!

Put the parts in order to form a sentence:

are the fundamental units in mechanics and other quantities in terms of these basic units. Length (L), Mass (M) and Time (T) may be expressed

VII.
Nanotechnology and its Applications in Medicine

1. Read:

Advancement in the field of nanotechnology and its applications to the field of medicines and pharmaceuticals has revolutionized the twentieth century. Nanotechnology is the study of extremely small structures. The prefix “nano” is a Greek word which means “dwarf”. The word “nano” means very small or miniature size. Nanotechnology is the treatment of individual atoms, molecules, or compounds into structures to produce materials and devices with special properties. Nanotechnology involves work from top down, i.e. reducing the size of large structures to smallest structure e.g. photonics applications in nano electronics and nano engineering, top-down or the bottom up, which involves changing individual atoms and molecules into nanostructures and more closely resembles chemistry biology. Nanotechnology deals with materials in the size of 0.1 to 100 nm; however, it is also inherent that these materials should display different properties such as electrical conductance, chemical reactivity, magnetism, optical effects and physical strength, from bulk materials as a result of their small size.

2. Summarize!

Put the parts in order to form a sentence:

individual atoms, molecules, or compounds into structures to produce materials and devices Nanotechnology is the treatment of with special properties.

VIII.

Medical Biotechnology: Techniques and Applications

1. Read:

The field of medical biotechnology is experiencing rapid growth in recent years, leading to the development of several innovative techniques for preventing, diagnosing, and treating diseases. Novel methodologies, including polymerase chain reaction, gene sequencing, fluorescence in situ hybridization, microarrays, cell culture, gene silencing using interference ribonucleic acid(RNA), and genome editing, have significantly contributed towards improving health science, such as the sequencing of the human genome, use of stem cells for regenerative medicine, tissue engineering, development of antibiotics, and the generation of monoclonal antibodies for therapy. If the current growth rate continues, medical biotechnology will soon become a major pillar of health science. Biotechnology and bioengineering are disciplines of science, which use knowledge of biological sciences and advanced technologies to generate new and useful products and processes for the benefit of society. The potential of biotechnology and bioengineering is immense because it touches the entire spectrum of life including agriculture, food processing, medicine, and many other areas.

2. Summarize!

Put the parts in order to form a sentence:

are disciplines of biological sciences and advanced technologies Biotechnology and bioengineering products and processes. science, which use knowledge of to generate new and useful

IX.

Nanotechnology in health and medicine

1. Read:

Even today various diseases like diabetes, cancer, Parkinson's disease, Alzheimer's disease, cardiovascular diseases and multiple sclerosis as well as different kinds of serious inflammatory or infectious diseases, (e.g. HIV) constitute a high number of serious and complex illnesses which are posing a major problem for the mankind. Nanomedicine is an application of nanotechnology which works in the field of health and medicine. Nano-medicine makes use of nano materials, and nano electronic biosensors. In the future, nano medicine will benefit molecular nanotechnology. The medical area of nano science application has many projected benefits and is potentially valuable for all human races. With the help of nano medicine early detection and prevention, improved diagnosis, proper treatment and follow-up of diseases is possible. Certain nano scale particles are used as tags and biological labels can be performed quickly, the testing has become more sensitive and more flexible. Gene sequencing has become more efficient with the invention of nano devices like gold nano particles, these gold particles when tagged with short segments of DNA (deoxyribonucleic acid) can be used for detection of genetic sequence in a sample. With the help of nanotechnology, damaged tissue can be reproduced or repaired.

2. Summarize!

Put the parts in order to form a sentence:

and follow-up of diseases is possible. early detection and prevention, improved diagnosis, proper treatment With the help of nano medicine

X.

Medical diagnostics

1. Read:

Medical diagnosis is the process of determining which disease or condition explains a person's symptoms and signs. It is most often referred to as diagnosis with the medical context. The information required for diagnosis is typically collected from a history and physical examination of the person seeking medical care. Often, one or more diagnostic procedures, such as diagnostic tests, are also done during the process. Sometimes posthumous diagnosis is considered a kind of medical diagnosis. A medical test is a medical procedure performed to detect, diagnose, or monitor diseases, disease processes, susceptibility, and determine a course of treatment. It is related to clinical chemistry and molecular diagnostics, and the procedures are typically performed in a medical laboratory. Clinical chemistry (also known

as chemical pathology, clinical biochemistry or medical biochemistry) is the area of chemistry that is generally concerned with analysis of bodily fluids for diagnostic and therapeutic purposes. Molecular diagnostics is a collection of techniques used to analyze biological markers in the genome and proteome—the individual's genetic code and how their cells express their genes as proteins—by applying molecular biology to medical testing.

2. Summarize!

Put the parts in order to form a sentence:

a history and physical examination of required for diagnosis is The information the person seeking medical care. typically collected from

Grammar Tests

Grammar 1

Read and choose the correct word for each space:

a are be is of the

The biomechanical model (1)_____ considered to simulate the interactions and deformations of the pelvic organs due to concomitant distensions of the urinary bladder and rectum organs. Finite element simulations (2)_____ performed in the framework of large deformation, adopting (3)_____ total Lagrangian formulation. The elastic strains are calculated and it appears that the bladder is more distended than the rectum; this could (4)_____ attributed to the fact that vesical tissue is softer than rectal tissue and more kinematic constraints are applied to the rectum. We maintain the necessity (5)_____ using hyperelastic constitutive laws for the bladder whose strains reach high levels, and the worthlessness of modeling heterogeneity for the prostate since no significant strains can be noticed numerically for (6)_____ gland.

Grammar 2

Read and choose the correct word for each space:

a allow are be is the to

The computer graphic biomechanical models (1)_____ kinematics analysis of the musculoskeletal joints. Kinematic data (2)_____ applied to the graphic models to animate experimentally measured or theoretical joint motions. Several techniques can (3)_____ used to record joint motions experimentally. The most commonly used devices (4)_____ 3D video capture systems, electromagnetic sensors, and electrogoniometers. Animation of experimentally measured motions requires construction of (5)_____ global coordinate system within a workstation environment that matches the global coordinate system used experimentally. Typically, external markers define the position of each limb segment throughout (6)_____ motions. These markers should be rigidly fixed to the bones of interest, but often are fixed to the skin, creating experimental artifacts due to the relative motion of the skin with respect to the

bone. The markers generally are positioned on the body with respect (7)_____ anatomic landmarks.

Grammar 3

Read and choose the correct word for each space:

a been is the to were

Our approach has (1)_____ to consider the pelvic organs and their muscular and connective tissue supports as interrelated components of a single system. We rely on detailed anatomical dissections and cross-sectional image review, carefully documented clinical evidence and basic biomechanical theory (2)_____ guide us in choosing candidate components in the model. The models are then used to test clinically relevant hypotheses. The assumptions made in these models (3)_____ based on our best understanding of the functional anatomy at the time. We have also taken care to validate our models against clinical data and to refine our assumptions if necessary so that the model behavior (4)_____ similar to that seen in patients. It has been our experience that making a model has often shown us where our previous assumptions were incorrect, it has sometimes caused us to go back and revisit (5)_____ real anatomy in a cadaver dissection or on histology, and this has been helpful in leading to (6)_____ better understanding of structure and function.

Grammar 4

Read and choose the correct word for each space:

a in of on the to

While biomechanical modeling has helped us make progress (1)_____ understanding the mechanics of prolapse, important knowledge gaps still remain. First, there is a lack (2)_____ data on the in vivo behavior of many pelvic floor tissues under physiological loading conditions, and this poses a major challenge. An alternative approach is to use inverse finite-element modeling approach (3)_____ estimate tissue properties based (4)_____ loading and deformation relationships observed in living women. However the solution of the inverse process is not always unique, especially when (5)_____ underlying finite-element models become too complicated. Second, the natural history of the disease process can be as long as several decades, so future work is needed to elucidate how tissue adapts to structural impairments over (6)_____ longer period of time, how obesity affects matters, and how the aging process interacts with disease processes.

Grammar 5

Read and choose the correct word for each space:

a an is of the

Biomechanical analysis (1)_____ a useful tool for understanding the fundamental behavior of the pelvic floor system and should lead to useful clinical applications. An impediment to (2)_____ more wide-spread application of biomechanical analysis is (3)_____ difficulty and time-cost in developing a suitable computer model of the organs and muscles for an individual person from

medical image data. This chapter discusses the underlying issue in developing (4)_____ analysis-suitable geometry using industry-standard methods, presents an alternative approach to significantly reduce the burden of patient-specific model generation, and demonstrates the usefulness of the approach with several examples (5)_____ biomechanical analysis in the female pelvic floor.

Grammar 6

Read and choose the correct word for each space:

a is of the to

The quick evolution of biomedical equipment and information technology together with the raising need of integration (1)_____ data, signals and images in the hospital produce the need of specialized expertise in computer science and clinical engineering. The health care process (2)_____ complex. The management tools (3)_____ make strategic decisions depend on the quality of information. The information for health care service management is generated from two different systems: the administrative system and health care medical record. Information technology should play (4)_____ large part in the integration of these two systems. The partial outsourcing of the integration process and further operations, including clinical engineering services, is the solution of choice to let health care institutions deal with (5)_____ more appropriate clinic activities only.

Grammar 7

Read and choose the correct word for each space:

a as be has is the to

In the typical CMMS, when new equipment (1)_____ received, a biomedical equipment technician (BMET) ensures that the order is complete; inspects and tests the device in accordance with the service manual that is provided as part of the order; and, based on the type of device, the organization's inclusion criteria, and the policies of the clinical engineering organization, determines whether the device needs (2)_____ be included in the equipment management program. If it does, the BMET then enters (3)_____ new item onto the database (or completes a form so that (4)_____ data entry clerk can enter it) as well as completing an incoming inspection work order. Device descriptions and other fields should (5)_____ made as consistent as possible by using the ECRI device nomenclature (ECRI, 1994) and relational database techniques where, for example, each unique model entry (6)_____ one entry that is referenced by all equipment entries of that model. Each model and device type also can include various defaulted fields (e.g., scheduled maintenance information such (7)_____ inspection frequency and maintenance procedure reference).

Grammar 8

Read and choose the correct word for each space:

been in is of on to

Biomedical engineering (1)_____ a board field that mainly represents aspects of biomaterials, bioinformatics, biomechanics, bioinstrumentation to aid in medicine and health. In this article, we discuss the use (2)_____ biomaterials that facilitate the interaction between the body and materials present on the surface level of biomedical devices. This is important in the successful use of biomedical devices because if the immune system rejects the biomaterials present (3)_____ the device, the device will fail and cause a severe immune response in the human body. With advancements in nanotechnology and materials science, there have (4)_____ further studies of biomaterials for tissue engineering and drug delivery methods. In this article we discuss both natural and synthetic polymers used (5)_____ biomaterials and their characteristics. Understanding their properties has allowed biomedical engineers (6)_____ make vast improvements in the field of biomaterials, and the lives of patients.

Grammar 9

Read and choose the correct word for each space:

a be is of or the to

Engineers often design and build systems (1)_____ a predetermined specification. They often use a model to predict how the system will behave because a model (2)_____ efficient and economical. The model that is built is called a plant and consists (3)_____ parameters that completely describe the system, the characteristic equation. The engineer selects the parameters of the plant to achieve (4)_____ certain set of specifications such as rise time, settling time, or peak overshoot time. In contrast, biomedical engineers involved with physiological modeling do not build the physiological system, but only observe the behavior of the system—the input and output of (5)_____ system—and then characterize it with a model. The goal of physiological modeling is not to design a system, but to identify the components ((6)_____ parameters) of the system. Most often, data needed for building the model are not the data that can (7)_____ collected using existing bioinstrumentation and biosensors.

biosensors.

Grammar 10

Read and choose the correct word for each space:

a are is of the to

Engineers often design and build systems (1)_____ a predetermined specification. They often use a model to predict how the system will behave because a model (2)_____ efficient and economical. The model that is built is called a plant and consists (3)_____ parameters that completely describe the system: the characteristic equation. The engineer selects the parameters of the plant to achieve (4)_____ certain set of specifications such as rise time, settling time, or peak overshoot time. In contrast, biomedical engineers involved with physiological modeling do not build the physiological system but only observe the behavior of the system—the input and output of (5)_____ system—and then characterize it with a model. Most often, data needed for building the model (6)_____ not the data that can be collected using existing bioinstrumentation, biosensors, and biosignal processing.

Lexical tests

Lexis 1

Read and choose the correct word for each space:

body mechanics muscles neuromuscular rehabilitation treatment

Biomechanics combines the field of engineering (1)_____ with the fields of biology and physiology. Biomechanics applies mechanical principles to the human (2)_____ in order to understand the mechanical influences on bone and joint health. Forces that load the joints are generated by (3)_____ and transmitted by tendons. Bones must withstand these forces. Developments in the field of biomechanics have improved our understanding of normal and pathologic gait, mechanics of (4)_____ control, and mechanics of growth and form. This knowledge has contributed to the development of medical diagnostic and (5)_____ procedures. It has provided the basis for the design and manufacture of medical implants and orthotic devices and has enhanced (6)_____ therapy practices.

Lexis 2

Read and choose the correct word for each space:

biomechanics cellular injury pathophysiology spinal tissue

Biomechanics is considered one of the core disciplines to understand principles of physiology and (1)_____ in the human. Decades of biomechanics research revealed many primary principles regulating growth, (2)_____ formation, organism morphogenesis, and tissue regeneration. Not surprisingly, (3)_____ is one of the core sciences used to understand how dynamic loading in the central nervous system (CNS) causes injury. This key transition from physiology to pathophysiology is especially important, as early pathophysiologic changes to the CNS can strongly influence (4)_____ decisions to survive, reintegrate, and repair the injured CNS. This long-term response, initiated when forces are transferred to the cellular/molecular scale at the time of (5)_____, is a key contributor in the outcome of head-injured and (6)_____ cord-injured patients.

Lexis3

Read and choose the correct word for each space:

biological bone clinical mechanical quantitative

The objective of predicting entire (1)_____ mechanics based on information available at tissue level and structural composition finds its motivation both from pure cognitive aspects but also from its (2)_____ relevance in fracture predictions and optimization of bone implants in the context of a patient-specific approach. It is here challenging to formulate (3)_____ relationships between microscale variables characterizing the material and structural properties and the apparent (4)_____ response. Bone adaptation and remodeling is driven by a rather complex cellular machinery involving a cascade of cellular

reactions, thereby highlighting the existing strong coupling between (5)_____ and mechanical phenomena.

Lexis 4

Read and choose the correct word for each space:

brain injury loading loadings response unloading

Compared to nearly every other application of biomechanics and human body, biomechanics of traumatic (1)_____ has three unique components. First, the mechanical event is nearly always considered as a single event, rather than a series of cyclical (2)_____ that are applied to organ/tissue/cellular preparations. In other areas of biomechanics, cyclical loading of tissue/cellular components is critical in defining the homeostatic response and the adaptation of this (3)_____ during disease. Examples include the periodic distension of the vascular wall during the cardiovascular cycle, or the frequent loading and (4)_____ of orthopedic soft tissues during gait. In contrast, the (5)_____ and spinal cord are considered "mechanically protected" organs and do not have a clear constant level of mechanical stimulation. Second, traumatic loading is probably the fastest event studied in biomechanics, especially considering the very recent work on blast (6)_____ biomechanics.

Lexis 5

Read and choose the correct word for each space:

biochemical cells consider genomic respond study

The conversion of the mechanical input to the resulting (1)_____ cascades – termed mechanotransmission – triggers the evolving injury patterns in the brain and spinal cord after traumatic injury. The concept of mechanotransmission has transformed biomechanics from a (2)_____ of structure-property relationships into a more integrated structure-function-property triad across lengths scales in the CNS. At the most reductionist level, this means that we are now beginning to explore how some (3)_____ respond directly to the mechanical load with a set of biochemical signatures, even now extending these into (4)_____ signatures. Not surprisingly, as the mechanical load is adjusted to either individual cells or clusters of cells, one may find that some cell types (5)_____ while others do not. Any biomechanically based study of events at the cellular and molecular scale must (6)_____ the physical wiring of the structure.

Lexis 6

Read and choose the correct word for each space:

application daily forces limb quick upper

Biomechanics is quite simply the application of (1)_____ and their effects on the biologic system. In the human body these are the effects of the (2)_____ of forces to the human body. In the case of the upper (3)_____ this could include internal or external forces. Knowing and understanding the range of forces that are unique in the (4)_____ limb will help the health care team to appropriately create the intended design and treatment plan. In the

case of the upper limb, muscles are typically attached close to joints, favoring efficiency, speed, and fine motor movements. For the most part, internal muscles of the upper limb such as the lumbricals, triceps, biceps, and flexor digitorum are optimized for fine (5)_____ movements over a larger ROM. Correctly designed orthoses should consider the internal forces of the limb segments being treated and the application of external forces that will be applied to the limbs as required by the patient's environment, chosen profession, or activities of (6)_____ living.

Lexis 7

Read and choose the correct word for each space:

biomechanics move movement prevention still strategies

Biomechanics is the study of human (1)_____ and includes not only the sole description of human movement (kinematics), but also the forces that cause those movements (kinetics). During gaming, esports athletes, despite sitting (2)_____ at a desk for long period of time during matches and events, display highly coordinated movement patterns that allow them to maintain very precise control of their character as they (3)_____ about the virtual world, and perform numerous tasks, including the attack and defense against enemies. To date, little to no work has examined the motor (4)_____ that gamers of varying levels of expertise employ while they play different gaming genres or even different characters/roles within a genre. The quantification of both the movement patterns and forces produced by the top athletes in all traditional sports has been addressed by a copious amount of research to date and sport (5)_____ continues to be a topical area. Numerous biomechanical measures have been used to improve coaching methods at both the professional and amateur levels, improve feedback to the athlete so that they may better understand their own proprioceptive abilities, leading to more efficient movement patterns, and assist in the (6)_____ of injury.

Lexis 8

Read and choose the correct word for each space:

clinical load-bearing microstructure modern significantly ways

Biomechanics has a long and storied history, but its (1)_____ era began in the mid-1960s. These past 50 years have yielded tremendous advances, evidenced both by illuminating basic discoveries and important (2)_____ applications. Nevertheless, much remains to be achieved. Among the many areas of need, we must understand better the basic processes by which (3)_____ soft tissues develop (morphogenesis), adapt (homeostasis), and change in disease (pathogenesis). Although these three processes differ in many (4)_____, underlying cell-mediated mechanisms are likely similar and, consequently, there is motivation and hope that common theoretical frameworks may provide (5)_____ increased insight and broad applicability. This search naturally leads to the subject of mathematically modeling growth and remodeling (G&R): that is, describing and predicting potential changes in mass (growth) and changes in (6)_____ (remodeling).

Lexis 9

Read and choose the correct word for each space:

conditions displacements material micromechanical non-typical stretch

Biomechanics is defined as mechanics applied to biology, and mechanics itself is the response of bodies to forces or (1)_____. For example, when we displace (or try to displace) a body, it may move or it may (2)_____. It is important to study the mechanics of skin so that we can understand how it will behave under different conditions (for example, we may be interested in seeing how the skin behaves in (3)_____ environments – deep-sea diving, sky diving) or we may be interested in seeing how the skin responds to various medical interventions, such as (4)_____ force therapies (or even non-medical interventions, such as various forms of body modifications including neck rings, used by certain tribes in Thailand, and body piercing). External (5)_____ applied to a system that we are studying are termed boundary conditions. We can have externally applied forces or we can have externally applied displacements. Forces and displacements are related through the constitutive laws describing the behavior of the (6)_____ we are studying.

Lexis 10

Read and choose the correct word for each space:

identified magnetic models muscles pathology properties

Computational biomechanical (1)_____ of the pelvic floor offer novel and quantitative ways to reliably assess pelvic floor mechanics during childbirth, and have the potential to elucidate mechanisms for the development of pelvic floor disorders and offer structural analysis of different surgical repair options in cases of (2)_____, for example, for pelvic organ prolapse (POP) repair. Computational modeling involves a complex integration of the anatomical, mechanical, and physiological (3)_____ of the pelvic floor muscles (PFMs). Defining the geometry of the muscles is relatively straightforward, and has been carried out using (4)_____ resonance images (MRIs) of the region of interest. Most MRI scanners now provide high-quality images whereby the muscles, organs, and bones can be readily (5)_____ and segmented. Anatomically accurate models are now possible to produce. However, incorporating the functionality of the (6)_____ and other structures remains challenging.

Translation Tests

Translation 1

Read:

The design of medical devices constitutes a major segment of the field of biomedical engineering.

Arrange the phrases in order to form a translation sentence:

Конструкція медичних пристроїв області біомедичної інженерії. основний сегмент становить

Translation 2

Read:

Biomedical engineering has only recently emerged as its own study, compared to many other engineering fields.

Arrange the phrases in order to form a translation sentence:

Біомедична інженерія тільки недавно в порівнянні з багатьма іншими з'явилася в якості інженерними областями. самостійної галузі дослідження,

Translation 3

Read:

The tricorder indicates a biomechanical presence.

Arrange the phrases in order to form a translation sentence:

на клітинному наявність рівні. Трікордер показує якихось биомеханизмов

Translation 4

Read:

It is essentially a functional entity, which may influence biomechanical and neural integrity.

Arrange the phrases in order to form a translation sentence:

біомеханічну і може впливати на невральної цілісність. По суті, це функціональний об'єкт, який

Translation 5

Read:

So we put quite a bit of biomechanical knowledge into this thing, and tried to make it as realistic as possible.

Arrange the phrases in order to form a translation sentence:

максимально Ми заклали в неї основи біомеханіки і реалістичною. спробували зробити її

Translation 6

Read:

In the hospital and in the entire region there's not a single biomedical engineer.

Arrange the phrases in order to form a translation sentence:

інженера-Біомедика. немає жодного У цій лікарні, усьому регіоні, як і в

Translation 7

Read:

For example, at the University of Minnesota, there's a biomedical engineer named David Odde, and he works with dancers to study how cells move.

Arrange the phrases in order to form a translation sentence:

з університету Міннесоти, інженер з біомедичної обладнання, Наприклад, Девід Одде працює з танцюристами, рухаються клітини. щоб вивчити, як

Translation 8

Read:

Biomedical engineers are currently researching methods of creating such organs.

Arrange the phrases in order to form a translation sentence:

Біомедичні технологи та в даний час досліджують інженери методи створення таких органів.

Translation 9

Read:

Biomedical engineers work hand in hand with doctors to build these artificial body parts.

Arrange the phrases in order to form a translation sentence:

Біомедичні інженери з лікарями, працюють рука об руку штучні частини тіла. щоб побудувати ці

Translation 10

Read:

The design of medical devices constitutes a major segment of the field of biomedical engineering.

Arrange the phrases in order to form a translation sentence:

Конструкція медичних пристроїв області біомедичної інженерії. основний сегмент становить

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KEYS

Reading and Comprehension Tests

I.

The study of measurement is a basic requirement in any field of science and technology, most essential in engineering and manufacturing.

II.

CT scanner invention initiated a revolution in diagnostic technology by allowing us to look inside a person.

III.

The branch of physical science that deals with the state of rest or the state of motion is termed as Mechanics.

IV.

Biophysics covers all scales of biological organization, from molecular to organismic and populations.

V.

Almost all areas of the life sciences are being uncovered and developed by biochemical methodology.

VI.

Length (L), Mass (M) and Time (T) are the fundamental units in mechanics and other quantities may be expressed in terms of these basic units.

VII.

Nanotechnology is the treatment of individual atoms, molecules, or compounds into structures to produce materials and devices with special properties.

VIII.

Biotechnology and bioengineering are disciplines of science, which use knowledge of biological sciences and advanced technologies to generate new and useful products and processes.

IX.

With the help of nano medicine early detection and prevention, improved diagnosis, proper treatment and follow-up of diseases is possible.

X.

The information required for diagnosis is typically collected from a history and physical examination of the person seeking medical car

Grammar Tests

Grammar 1

The biomechanical model *is* considered to simulate the interactions and deformations of the pelvic organs due to concomitant distensions of the urinary bladder and rectum organs. Finite element simulations *are* performed in the framework of large deformation, adopting *a* total Lagrangian formulation. The elastic strains are calculated and it appears that the bladder is more distended than the rectum; this could *be* attributed to the fact that vesical tissue is softer than rectal tissue and more kinematic constraints are applied to the rectum. We maintain the necessity *of* using hyperelastic constitutive laws for the bladder whose strains reach high levels, and the worthlessness of modeling heterogeneity for the prostate since no significant strains can be noticed numerically for *the* gland.

Grammar 2

The computer graphic biomechanical models *allow* kinematics analysis of the musculoskeletal joints. Kinematic data *is* applied to the graphic models to animate experimentally measured or theoretical joint motions. Several techniques can *be* used to record joint motions experimentally. The most commonly used devices *are* 3D video capture systems, electromagnetic sensors, and electrogoniometers. Animation of experimentally measured motions requires construction of *a* global coordinate system within a workstation environment that matches the global coordinate system used experimentally. Typically, external markers define the position of each limb segment throughout *the* motions. These markers should be rigidly fixed to the bones of interest, but often are fixed to the skin, creating experimental artifacts due to the relative motion of the skin with respect to the bone. The markers generally are positioned on the body with respect *to* anatomic landmarks.

Grammar 3

Our approach has *been* to consider the pelvic organs and their muscular and connective tissue supports as interrelated components of a single system. We rely on detailed anatomical dissections and cross-sectional image review, carefully documented clinical evidence and basic biomechanical theory *to* guide us in choosing candidate components in the model. The models are then used to test clinically relevant hypotheses. The assumptions made in these models *were* based on our best understanding of the functional anatomy at the time. We have also taken care to validate our models against clinical data and to refine our assumptions if necessary so that the model behavior *is* similar to that seen in patients. It has been our experience that making a model has often shown us where our previous assumptions were incorrect, it has sometimes caused us

to go back and revisit *the* real anatomy in a cadaver dissection or on histology, and this has been helpful in leading to *a* better understanding of structure and function.

Grammar 4

While biomechanical modeling has helped us make progress *in* understanding the mechanics of prolapse, important knowledge gaps still remain. First, there is a lack *of* data on the in vivo behavior of many pelvic floor tissues under physiological loading conditions, and this poses a major challenge. An alternative approach is to use inverse finite-element modeling approach *to* estimate tissue properties based *on* loading and deformation relationships observed in living women. However the solution of the inverse process is not always unique, especially when *the* underlying finite-element models become too complicated. Second, the natural history of the disease process can be as long as several decades, so future work is needed to elucidate how tissue adapts to structural impairments over *a* longer period of time, how obesity affects matters, and how the aging process interacts with disease processes.

Grammar 5

Biomechanical analysis *is* a useful tool for understanding the fundamental behavior of the pelvic floor system and should lead to useful clinical applications. An impediment to *a* more wide-spread application of biomechanical analysis is *the* difficulty and time-cost in developing a suitable computer model of the organs and muscles for an individual person from medical image data. This chapter discusses the underlying issue in developing *an* analysis-suitable geometry using industry-standard methods, presents an alternative approach to significantly reduce the burden of patient-specific model generation, and demonstrates the usefulness of the approach with several examples *of* biomechanical analysis in the female pelvic floor.

Grammar 6

The quick evolution of biomedical equipment and information technology together with the raising need of integration *of* data, signals and images in the hospital produce the need of specialized expertise in computer science and clinical engineering. The health care process *is* complex. The management tools *to* make strategic decisions depend on the quality of information. The information for health care service management is generated from two different systems: the administrative system and health care medical record. Information technology should play *a* large part in the integration of these two systems. The partial outsourcing of the integration process and further operations, including clinical engineering services, is the solution of choice to let health care institutions deal with *the* more appropriate clinic activities only.

Grammar 7

In the typical CMMS, when new equipment *is* received, a biomedical equipment technician (BMET) ensures that the order is complete; inspects and tests the device in accordance with the service
manual that new item onto the database (or completes a form so that *a* data entry clerk can enter it) as well as
completing an incoming inspection work order. Device descriptions and other fields should *be* made as consistent as possible by using the ECRI device nomenclature (ECRI, 1994) and

relational database techniques where, for example, each unique model entry *has* one entry that is referenced by all equipment entries of that model. Each model and device type also can include various defaulted fields (e.g., scheduled maintenance information such *as* inspection frequency and maintenance procedure reference).

Grammar 8

Biomedical engineering *is* a board field that mainly represents aspects of biomaterials, bioinformatics, biomechanics, bioinstrumentation to aid in medicine and health. In this article, we discuss the use *of* biomaterials that facilitate the interaction between the body and materials present on the surface level of biomedical devices. This is important in the successful use of biomedical devices because if the immune system rejects the biomaterials present *on* the device, the device will fail and cause a severe immune response in the human body. With advancements in nanotechnology and materials science, there have *been* further studies of biomaterials for tissue engineering and drug delivery methods. In this article we discuss both natural and synthetic polymers used *in* biomaterials and their characteristics. Understanding their properties has allowed biomedical engineers *to* make vast improvements in the field of biomaterials, and the lives of patients.

Grammar 9

Engineers often design and build systems *to* a predetermined specification. They often use a model to predict how the system will behave because a model *is* efficient and economical. The model that is built is called a plant and consists *of* parameters that completely describe the system, the characteristic equation. The engineer selects the parameters of the plant to achieve *a* certain set of specifications such as rise time, settling time, or peak overshoot time. In contrast, biomedical engineers involved with physiological modeling do not build the physiological system, but only observe the behavior of the system—the input and output of *the* system—and then characterize it with a model. The goal of physiological modeling is not to design a system, but to identify the components (*or* parameters) of the system. Most often, data needed for building the model are not the data that can *be* collected using existing bioinstrumentation and

Grammar 10

Engineers often design and build systems *to* a predetermined specification. They often use a model to predict how the system will behave because a model *is* efficient and economical. The model that is built is called a plant and consists *of* parameters that completely describe the system: the characteristic equation. The engineer selects the parameters of the plant to achieve *a* certain set of specifications such as rise time, settling time, or peak overshoot time. In contrast, biomedical engineers involved with physiological modeling do not build the physiological system but only observe the behavior of the system—the input and output of *the* system—and then characterize it with a model. Most often, data needed for building the model *are* not the data that can be collected using existing bioinstrumentation, biosensors, and biosignal processing.

Lexical tests

Lexis 1

Biomechanics combines the field of engineering *mechanics* with the fields of biology and physiology. Biomechanics applies mechanical principles to the human *body* in order to understand the mechanical influences on bone and joint health. Forces that load the joints are generated by *muscles* and transmitted by tendons. Bones must withstand these forces. Developments in the field of biomechanics have improved our understanding of normal and pathologic gait, mechanics of *neuromuscular* control, and mechanics of growth and form. This knowledge has contributed to the development of medical diagnostic and *treatment* procedures. It has provided the basis for the design and manufacture of medical implants and orthotic devices and has enhanced *rehabilitation* therapy practices.

Lexis 2

Biomechanics is considered one of the core disciplines to understand principles of physiology and *pathophysiology* in the human. Decades of biomechanics research revealed many primary principles regulating growth, *tissue* formation, organism morphogenesis, and tissue regeneration. Not surprisingly, *biomechanics* is one of the core sciences used to understand how dynamic loading in the central nervous system (CNS) causes injury. This key transition from physiology to pathophysiology is especially important, as early pathophysiologic changes to the CNS can strongly influence *cellular* decisions to survive, reintegrate, and repair the injured CNS. This long-term response, initiated when forces are transferred to the cellular/molecular scale at the time of *injury*, is a key contributor in the outcome of head-injured and *spinal* cord-injured patients.

Lexis 3

The objective of predicting entire *bone* mechanics based on information available at tissue level and structural composition finds its motivation both from pure cognitive aspects but also from its *clinical* relevance in fracture predictions and optimization of bone implants in the context of a patient-specific approach. It is here challenging to formulate *quantitative* relationships between microscale variables characterizing the material and structural properties and the apparent *mechanical* response. Bone adaptation and remodeling is driven by a rather complex cellular machinery involving a cascade of cellular reactions, thereby highlighting the existing strong coupling between *biological* and mechanical phenomena.

Lexis 4

Compared to nearly every other application of biomechanics and human body, biomechanics of traumatic *loading* has three unique components. First, the mechanical event is nearly always considered as a single event, rather than a series of cyclical *loadings* that are applied to organ/tissue/cellular preparations. In other areas of biomechanics, cyclical loading of tissue/cellular components is critical in defining the homeostatic response and the adaptation of this *response* during disease. Examples include the periodic distension of the vascular wall during the cardiovascular cycle, or the frequent loading and *unloading* of orthopedic soft tissues during gait. In contrast, the *brain* and spinal cord are considered “mechanically protected” organs and do not have a clear constant level of mechanical stimulation. Second, traumatic loading is probably the fastest event studied in biomechanics, especially considering the very recent work on blast *injury* biomechanics.

Lexis 5

The conversion of the mechanical input to the resulting *biochemical* cascades – termed mechanotransmission – triggers the evolving injury patterns in the brain and spinal cord after traumatic injury. The concept of mechanotransmission has transformed biomechanics from a *study* of structure-property relationships into a more integrated structure-function-property triad across lengths scales in the CNS. At the most reductionist level, this means that we are now beginning to explore how some *cells* respond directly to the mechanical load with a set of biochemical signatures, even now extending these into *genomic* signatures. Not surprisingly, as the mechanical load is adjusted to either individual cells or clusters of cells, one may find that some cell types *respond* while others do not. Any biomechanically based study of events at the cellular and molecular scale must *consider* the physical wiring of the structure.

Lexis 6

Biomechanics is quite simply the application of *forces* and their effects on the biologic system. In the human body these are the effects of the *application* of forces to the human body. In the case of the upper *limb* this could include internal or external forces. Knowing and understanding the range of forces that are unique in the *upper* limb will help the health care team to appropriately create the intended design and treatment plan. In the case of the upper limb, muscles are typically attached close to joints, favoring efficiency, speed, and fine motor movements. For the most part, internal muscles of the upper limb such as the lumbricals, triceps, biceps, and flexor digitorum are optimized for fine *quick* movements over a larger ROM. Correctly designed orthoses should consider the internal forces of the limb segments being treated and the application of external forces that will be applied to the limbs as required by the patient's environment, chosen profession, or activities of *daily* living.

Lexis 7

Biomechanics is the study of human *movement* and includes not only the sole description of human movement (kinematics), but also the forces that cause those movements (kinetics). During gaming, esports athletes, despite sitting *still* at a desk for long period of time during matches and events, display highly coordinated movement patterns that allow them to maintain very precise control of their character as they *move* about the virtual world, and perform numerous tasks, including the attack and defense against enemies. To date, little to no work has examined the motor *strategies* that gamers of varying levels of expertise employ while they play different gaming genres or even different characters/roles within a genre. The quantification of both the movement patterns and forces produced by the top athletes in all traditional sports has been addressed by a copious amount of research to date and sport *biomechanics* continues to be a topical area. Numerous biomechanical measures have been used to improve coaching methods at both the professional and amateur levels, improve feedback to the athlete so that they may better understand their own proprioceptive abilities, leading to more efficient movement patterns, and assist in the *prevention* of injury.

Lexis 8

Biomechanics has a long and storied history, but its *modern* era began in the mid-1960s. These past 50 years have yielded tremendous advances, evidenced both by illuminating basic

discoveries and important *clinical* applications. Nevertheless, much remains to be achieved. Among the many areas of need, we must understand better the basic processes by which *load-bearing* soft tissues develop (morphogenesis), adapt (homeostasis), and change in disease (pathogenesis). Although these three processes differ in many *ways*, underlying cell-mediated mechanisms are likely similar and, consequently, there is motivation and hope that common theoretical frameworks may provide *significantly* increased insight and broad applicability. This search naturally leads to the subject of mathematically modeling growth and remodeling (G&R): that is, describing and predicting potential changes in mass (growth) and changes in *microstructure* (remodeling).

Lexis 9

Biomechanics is defined as mechanics applied to biology, and mechanics itself is the response of bodies to forces or *displacements*. For example, when we displace (or try to displace) a body, it may move or it may *stretch*. It is important to study the mechanics of skin so that we can understand how it will behave under different conditions (for example, we may be interested in seeing how the skin behaves in *non-typical* environments – deep-sea diving, sky diving) or we may be interested in seeing how the skin responds to various medical interventions, such as *micromechanical* force therapies (or even non-medical interventions, such as various forms of body modifications including neck rings, used by certain tribes in Thailand, and body piercing). External *conditions* applied to a system that we are studying are termed boundary conditions. We can have externally applied forces or we can have externally applied displacements. Forces and displacements are related through the constitutive laws describing the behavior of the *material* we are studying.

Lexis 10

Computational biomechanical *models* of the pelvic floor offer novel and quantitative ways to reliably assess pelvic floor mechanics during childbirth, and have the potential to elucidate mechanisms for the development of pelvic floor disorders and offer structural analysis of different surgical repair options in cases of *pathology*, for example, for pelvic organ prolapse (POP) repair. Computational modeling involves a complex integration of the anatomical, mechanical, and physiological *properties* of the pelvic floor muscles (PFMs). Defining the geometry of the muscles is relatively straightforward, and has been carried out using *magnetic* resonance images (MRIs) of the region of interest. Most MRI scanners now provide high-quality images whereby the muscles, organs, and bones can be readily *identified* and segmented. Anatomically accurate models are now possible to produce. However, incorporating the functionality of the *muscles* and other structures remains challenging.

Translation Tests

Translation 1

Конструкція медичних пристроїв становить основний сегмент області біомедичної інженерії.

Translation 2

Біомедична інженерія тільки недавно з'явилася в якості самостійної галузі дослідження, в порівнянні з багатьма іншими інженерними областями.

Translation 3

Трікордер показує наявність якихось биомеханизмов на клітинному рівні.

Translation 4

По суті, це функціональний об'єкт, який може впливати на біомеханічну і невральну цілісність.

Translation 5

Ми заклали в неї основи біомеханіки і спробували зробити її максимально реалістичною.

Translation 6

У цій лікарні, як і в усьому регіоні, немає жодного інженера-Біомедика.

Translation 7

Наприклад, Девід Одде з університету Міннесоти, інженер з біомедичної обладнання, працює з танцюристами, щоб вивчити, як рухаються клітини.

Translation 8

Біомедичні технологи та інженери в даний час досліджують методи створення таких органів.

Translation 9

Біомедичні інженери працюють рука об руку з лікарями, щоб побудувати ці штучні частини тіла.

Translation 10

Конструкція медичних пристроїв становить основний сегмент області біомедичної інженерії.