

**МИНОБРНАУКИ РОССИИ**  
Федеральное государственное бюджетное  
образовательное учреждение высшего образования  
«Юго-Западный государственный университет»  
(ЮЗГУ)

Кафедра иностранных языков

УТВЕРЖДАЮ  
Проректор по учебной работе  
\_\_\_\_\_ О.Г.Локтионова  
« \_\_\_\_ » \_\_\_\_\_ 2017г.

**КЕЙС-ЗАДАЧИ ПО ИНОСТРАННОМУ ЯЗЫКУ**

Методические указания для выполнения заданий  
в интерактивной форме  
для студентов 2 курса направления подготовки  
15.03.06 Мехатроника и робототехника

Курск 2017

УДК 811.111 (071.8)

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Кейс-задачи по иностранному языку: методические указания для выполнения заданий в интерактивной форме для студентов 2 курса направления подготовки 15.03.06 Мехатроника робототехника / Юго-Зап. гос. ун-т; сост.: В.Ю. Андреева; Курск, 2017. – 27 с.

Цель методических указаний сформировать у студентов второго курса умение использовать иностранный язык в ситуациях профессионального общения (решение кейс-задач), и для развития навыков аудирования и говорения, умения воспринимать и воспроизводить полученную информацию на иностранном языке.

Методические указания основаны на оригинальных материалах, задания ориентированы на активное обучение английскому языку и формирование основных понятий в рамках технических специальностей.

Методические указания соответствуют требованиям программы дисциплины «Иностранный язык» федерального компонента цикла общегуманитарных и социально-экономических дисциплин в ФГОС ВО.

Методические указания предназначены для студентов второго курса направления подготовки 15.03.06 Мехатроника и робототехника для практических занятий по дисциплине «Иностранный язык» (английский).

Текст печатается в авторской редакции

Подписано в печать . Формат 60x84 1/16. Бумага офсетная.  
Усл. печ. л. 1,6 . Уч.-изд. л. 1,4 .Тираж экз. Заказ . Бесплатно.  
Юго-Западный государственный университет.  
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## Unit I

### Definition of a robot.

#### Task 1. Case studies. At the design bureau

The problem concerning the automatization of manufacturing goods is being discussed. The chief engineer suggests that the traditional automated line should be arranged.

The laboratory chief insists on robot application. He tries to prove that robot application will simplify and reduce the cost of performing this task.

A. Agree with the lab chief's point of view indicating the advantages of the robot application.

B. Support the chief engineer's position saying that the application of special-purpose automation is just as important.

C. Prepare your own report on the problem of robot's application.

Use the information to help you: industrial robot's positive features:

- a) the operator needs no computer experience, makes no complex calculations;
- b) increased productivity and product quality;
- c) fast, easy installation;
- d) reduced energy consumption.

#### Task 2. Video. History of robotics.

*Pre-watching tasks:*

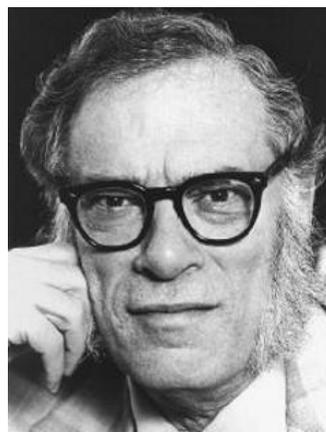
1. Read the extract and explain what the origin of the word "robot" is.

The word «robot» comes from the Czech word «robota», compulsory labour or work (also used in a sense of a serf), first used by Karel Čapek in his science fiction play R.U.R. (Rossum's Universal

Robots) in 1921, and according to Čapek, was invented by his brother, painter Josef Čapek. The word was brought into popular Western use by famous science fiction writer Isaac Asimov.



Karel Čapek



Isaac Asimov

2. Watch the video and answer the questions:

- What is the first year memorable to the history of robots?
- What robots are mentioned in the video? What do you know about them?

*After – watching tasks:*

3. Watch the video once again and write down the answers for the following questions:

- How did Karel Čapek invent the word “robot”?
- When was a mechanical trumpeter created?
- When was invented the first humanoid robot? What was its name?
- When did the first computer controlled robotic arm appear? Who was it invented for?
- When was invented the first robot who could navigate independently?
- When was a humanoid robot Asimo introduced?
- What is the year of invention of chess playing robots?
- What is said about the latest humanoid robot Reem B? What can he do?

## Unit II

### Classification of robots.

#### Task 1. Case studies.

#### At the Scientific Research Institute

Two designers are discussing the problem of what type of robot to choose to automate the production process. One of them considers that it is necessary to choose the robot with a greater degree of freedom. The other objects, indicating that in this case a simple cycle robot is adequate with non-sophisticated equipment.

A. Agree with the first designer. Underline the fact that additional equipment is not necessary.

B. Object to the first designer indicating that the cycle robot version is cheaper.

C. Give your own reason.

Use the following words and word combinations.

to improve capital equipment utilization; minimum cost; high return on your investment; to be opposed to special facilities; to reduce design and production of the additional equipment

#### Task 2. Video.

### Classification of robots.

Watch the video at home and fill in the table showing another variant of robot classification.

Robots													
Robots by locomotion							Robots by application						

Stationary robots					

Wheeled robots					

Legged robots					

Other robots					

### **Unit III**

#### **Types of locomotion.**

Task 1. Case studies.

#### **At the Scientific Research Institute**

Two engineers are discussing the problem of what type of robot to choose while rescuing people in destroyed buildings. One of them sees the best option in a snake robot, the other one suggests using a hexapod. Make up a dialogue between these two engineers. Give reasons which locomotion is preferable.

Task 2. Video.

#### **Types of locomotion**

Watch the video and answer the questions:

1. Where was this snake robot introduced?
2. How does it move? Is its motion the same on land and in water?
3. What is special about its joints?
4. What are robot's wheels and pedals necessary for?
5. Does the robot have a battery or a motor?
6. In what museum can you see this robot?

## **Unit IV**

### **Robot components**

Task 1. Case studies.

#### **At the robot laboratory**

Two postgraduates attending a robot seminar are discussing laboratory work on robot design.

One of them is surprised that the term "robot" is mostly associated with the manipulator and less attention is paid to the control system and power supply unit. The other objects, saying that the actuating part of any machine is most attractive and the manipulator, to a certain extent, defines the technical abilities and specific features of robots.

A. Agree with the first postgraduate pointing out what characteristics of the robot and its manipulator are adequate.

B. Express your point of view indicating that series of very important robot capabilities are connected with the controls.

Some terms will help you.

integral control cabinet; straight line interpolation; type of control system; PTP and CP movement control abilities; memory and program capacity; number of interlock channels with the equipment

## **Unit IV**

### **Manipulators**

Task 1. Case studies.

#### **At the robot laboratory**

The chief of the robotization department and the head of the lab are discussing the problem of automatized machine tool loading. The lab head suggests there should be strict part orientation before robot grasping. The chief of the department recommends that research is carried out into fitting gripping devices with sensors which allow the robot to select parts from the stack.

- A. Agree with the lab head, pointing out also the possibility of applying simple technology in this method.
- B. Support the chief's position pointing out that research should be undertaken into fitting gripping devices with sensors.
- C. Give your own opinion on this subject.

## **Unit VI**

### **End-effectors**

#### Task 1. Case studies. **At the design bureau**

A new hydraulic robot designed for painting products has been delivered to the shop. There is a complete set of interchangeable tools in a separate package. The foreman gives the students on practice the task: to join the painting gun to the wrist of robot.

The order of carrying out the task:

1. to install the spray gun of the mounting surface to the mounting area of the robot arm;
2. to insert fastening bolts into the holes and screw them in fixing the gun to the robot arm;
3. to connect hoses to the point spraying gun.

#### Task 2. Video. **Manipulators and end-effectors**

Watch the video and answer the questions:

1. What are five the most frequently used end-effectors?
2. What are grippers? How can they be driven?
3. Where is a grinder usually mounted on?
4. What is spray gun used for?
5. Where are robots equipped with ladles usually used?
6. What is an automatic tool changer?

## Unit VII

### Types of actuators

#### Task 1. Case studies. At the design bureau

The head of the design bureau and the leading engineer are solving the problem of choosing the type of robot with CP control system for painting under high temperature and humidity conditions.

The leading engineer suggests that the hydraulic robot with remote power supply unit should be used. The head of the design bureau insists on electromechanical robot application because it is less sensitive to external conditions.

A. Agree with the leading engineer's position because hydraulic spray-painting robots are better adapted for programming in the teach-manual mode.

B. Support the head of the design bureau pointing out the advantages of applying electromechanical robots.

C. Express your point of view.

Use additional information.

The hydraulic robot:

- special fire-resistant fluid;
- long hydraulic communication lines;
- path information is taught by actually operating the robot;
- larger work envelope;
- the possibility to realize more complicated trajectory

The electromechanical robot:

- doesn't require additional room for the power pack;
- has CP mode realization by means of interpolator (remote teaching method);
- less memory capacity;
- simple power supply

## Task 2. Video.

### Hydraulic and pneumatic actuators.

#### Part 1 “Hydraulic machines”.

1. Write down, translate and memorize the following words and word combinations:

Pressure, liquid, to be transmitted equally to all parts of the liquid, a syringe, to compress a liquid, a force multiplier, oil, to lubricate the moving parts of the machine, a jack, a brake system of a car, a heavy loader, a hydraulic spreader, pliers, a hydraulic cutter.

2. Watch part 1 of the video and answer the questions:

7. What is a hydraulic system? How does it work?
8. What are the main principles connected with the liquid?
9. Where is hydraulics used?

3. Watch the video once again and complete the sentences:

1. When a liquid is enclosed in a space and a pressure is applied to the liquid, this pressure ...
2. When the piston is pushed down water squirts out uniformly ... from the holes of the flask.
3. If you try to squash a volume of liquid you still have that same volume however hard ...

#### Part 2 “Pneumatic machines”.

1. Write down, translate and memorize the following words and word combinations:

A pneumatic drill, compressed air, a valve, a drill bit, turbine blades, outlet and inlet, nuts of the tyre, a pneumatic screwdriver.

2. Watch part 2 of the video and answer the questions:

10. What is a pneumatic system? How does it work?
11. What are the examples of pneumatic machines?

3. Watch the video once again and complete the sentences:

1. A pneumatic machine uses compressed air instead of ...

2. The piston compresses air in a pipe and the air pressure ...
3. Compressed air is first ... into the air inlet.

## Unit VIII

### Control systems

#### Task 1. Case studies. In the assembly shop

The shop superintendent and industrial engineers are considering the problem of choosing industrial robot modifications for welding.

The shop superintendent asks the engineer to provide information on the problem of which robots to buy. The engineer explains, that robots with PTP control system will be bought for spot-welding, and robots with CP control system will be bought for arc-welding. The superintendent does not quite agree with the "engineer.

- A. Explain the kind of control system suggested by the superintendent—CP system.
- B. Point to the features of coordinated action of robot control system with interlocking equipment.
- C. Give your own opinion on this problem.

Use additional information.

1. It is suited both to spot and arc welding.
2. Both modes are in the same unit.
3. To operate external equipment.
4. To be stopped by external equipment.

#### Task 2. Video. Control Systems. Prosthetic Hand

1. Watch the video and cover the main idea of it.
2. Watch the video once again and say whether the statements are

true or false.

- a) He is a third-year Electrical Engineering student at the university of Newcastle.
- b) His main interest is embedded systems and control design.
- c) His final project is devoted to electro-myographic control systems.
- d) Electro-myography is the study of electrical signals generated by muscle tissue.
- e) Alex uses the control system to know how the body works.

## **Unit IX**

### **Feedback systems.**

#### Task 1. Case studies. **At the design bureau**

Two research workers in the design bureau are discussing the experience of introducing tactile or visual information into the design of the assembly module.

The chief of the lab considers that tactile information is enough to grasp the object. The assistant chief of the lab objects pointing out that visual control of the object position would be a more effective design.

- A. Try to outline the assistant chief's arguments.
- B. Support the chief.
- C. Express your view-point on the subject under discussion.

Use additional information given below.

Tactile method requires: a) simple sensory equipment; b) not complex system of information processing;

- c) complex algorithm of manipulator hand motion;
- d) much time .for part search.

Visual method requires (or gives you): a) complex and expensive system of visual-servo control; b) special conveyer (and part) light system; c) great financial investment on computer technology; d) the ability to work in real time; e) the ability to grasp the object on a moving belt.

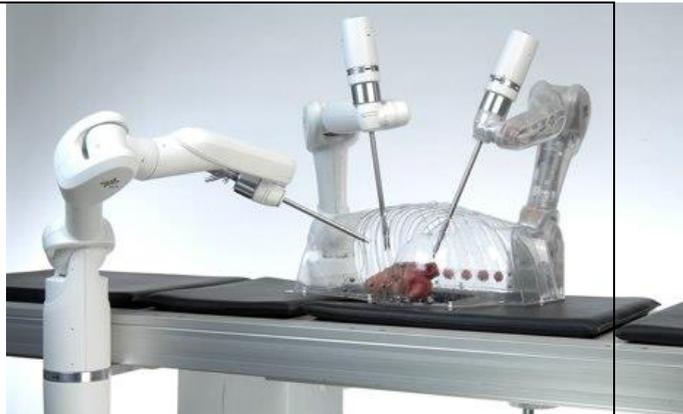
Task 2. Video.  
**Feedback systems in medical robots**

*Pre-watching tasks:*

1. What do you know about medical robots? What robots are these: Da Vinci surgical robot, telepresence rehabilitation robots, Human Patient Simulator robot?
2. Match the names with the pictures:

<p><b>1. The Da Vinci surgical system</b> (for performing remote operations)</p>	
<p><b>2. MiroSurge robotic system</b> (for minimally invasive telesurgery)</p>	
<p><b>3. Telepresence rehabilitation robots</b> (for monitoring the patient's health state and helping them to rehabilitate).</p>	

**4. Human Patient Simulator** (HPS robot. It allows dentists and other doctors to be trained using not a real human but a very similar robot).



3. Write down and memorize the words and word expressions:

*Surgery* – хирургия

*surgeon* – хирург

*The instruments can be angled.* – Инструменты могут располагаться под углом.

*Remotely* – удаленно

*torque sensor* – датчик крутящего момента

*endoscopic instrument* – эндоскопический прибор (позволяющий проникнуть внутрь тела пациента)

*command console* – командный пульт управления

*haptic* – тактильный

*additional glasses* – дополнительные линзы

*to augment* – увеличивать

*to scale* – масштабировать

*to give the surgeon better guidance* – чтобы хирург мог руководствоваться этой дополнительной информацией

4. Watch the video and answer the questions:

— What is a MiroSurge?

— How are the actions done during the operation: remotely or by the surgeon himself?

— What can be said about the manipulators of the robot?

— What are the advantages of this robot?

*After – watching tasks:*

5. Watch the video once again and fill in the blanks using information from the video.

This is our robotic system MiroSurge as it will be used in future surgery. It's always to operate on the patient as gently and precisely as possible. All actions will be done (1).... by the surgeon. Using the three robots, instruments and cameras will be positioned inside the patient's body. The instruments can be angled. This provides them with a very high (2)... inside the patient. The three arms you see here constitute our medical robot system MiroSurge. Torque sensors in each joint make the arms very (3)..... This enables the grabbing and moving of the robot structure making it very easy to insert the endoscopic instruments into the patient. This system is controlled remotely by the surgeon who will be sitting at this (4).... From there the surgeon tells the system with haptic input devices. Forces which are exerted on the organs are simultaneously measured and provided back to surgeon. The inside view of the patient is displayed to the surgeon on a stereo display. And autostereoscopic display is used here so that no additional glasses are required to get a stereo impression. The surgeon moves two (5)... which control the position and orientation of the two instruments inside the patient's body. In addition, the instruments measure the forces that appear during contact with the organs and return this information to the surgeon. Thus the surgeon feels exactly what the instruments feel as they push the organs.

Our system offers several advantages compared to (6)... minimally invasive surgery. First, the operation is much more (7)..., because it is based on an augmented view of the patient's interior and the movements are scaled accordingly. Second, it is possible to (8)... the instruments inside the patient; this allows for a much higher degree of (9) while operating. And third, the forces felt while touching the organs are also felt by the surgeon at the command console. This essentially means that sensitive feeling is brought back into minimally invasive surgery.

For the future we imagine assisting functions such as the automatic tracking of heart motion or augmenting the surgeon's feel the vision by overlaying additional information such as preoperative patient data to

give the surgeon better guidance. The aim is to provide MiroSurge to (10)... in the future. The many benefits that will arise from the system in the years to come can already be seen now. Nevertheless, there clearly remains a way to go from the certification of the system to the surgery in humans using MiroSurge.

6. Write the summary of the video fragment in Russian.

## Unit XII

### Industrial robots

#### Task 1. Case studies.

#### At the robot laboratory

The team leader and engineer are discussing the problem of automatic loading at a milling centre.

The engineer considers that it is necessary to install parts on the machine-tool pallet automatically. The team leader suggests installing parts on the machine-tool table as it is a more advanced solution.

- A. Agree with the engineer as his technical solution is simpler.
- B. Support the team leader indicating that his suggestion is more economical.

Use additional information.

Pallet system:

- to use standard machine-tool pallets;
- to load pallets without stopping machine-tool;
- to apply unified clamping facility;
- to use an additional power nut-driver

Without pallet system:

- doesn't require a great quantity of expensive pallets;
- doesn't require high capacitance of automatic pallet storage;
- requires a change of part design;
- part fixing on the machine-tool table is complicated.

#### Task 2. Video.

### Industrial robots

1. Write down and memorize these expressions:  
*welding gun* – сварочный пистолет

*paint spray nozzle* – краскораспылительное сопло

*disadvantage* – недостаток

*dexterity* – гибкость

*consistency* – согласованность действий

*flexibility* – перестраиваемость

2. Watch the video and say what examples of industrial robots are discussed in this fragment.

3. Watch the video once again and say whether the statements are true or false.

- 1) There are a multitude of tools used in industrial robots including welding guns (сварочный пистолет), paint spray nozzles (краскораспылительные сопла) and various machining tools.
- 2) Welding guns mounted on the wrist a robot have disadvantages before manually held welding guns or welding with fixed automation.
- 3) The advantages are the increased welding speed and relief from difficult welding environment for the humans.
- 4) Robotic welding can provide dexterity (гибкость), consistency (согласованность действий) and flexibility (перестраиваемость) to an operation and the product itself.
- 5) Robots are never used for both arc welding and spot welding operations.
- 6) Robots are necessary in high quality welding installations including automotive assembly lines and furniture and appliance manufacturing.

## Unit XIII

### Mobile robots

#### Task 1. Case studies.

#### At the robot laboratory

The engineers of NASA are discussing the conception of a new Mars rover. One of them suggests it should be not a rover, but a hexacopter for it to be able to fly into deep canyons and to explore inaccessible spots. Another one hopes that a snake robot would be the best option.

A. Agree with the opinion of the first engineer suggesting the hexacopter model.

B. Support the second engineer's opinion. He believes that the strengthened model of a snake robot would be more appropriate as it can also move to dangerous and remote places, and still, having a camera on it, it will give more information than a hexacopter.

C. Give your own opinion on this problem.

#### Task 2. Video.

#### Mobile robots

1. Watch the video and answer the questions:

- What sensors does the robot have?
- What is the problem with the maps for this robot?
- What are the components of the robot?
- How is the 3D image collected?

2. Watch the video one more time and match the parts of the robot with the actions they perform.

An Xbox controller	It has six different cameras, all arranged so that it captures the image pretty much of the whole hemisphere around the camera.
A DGPS	has thirty two lasers in a vertical configuration in every revolution (оборот), it collects 3D information.

antenna	
A “Ladybug”	drives the robot while the man is walking behind to be sure that it doesn't go off the curb and doesn't run into people.
Velo dyne 32 laser scanner	It is a differential GPS, it is a highly accurate GPS which they use for ground shoot (наземная съемка), the tele-algorithm they are working with.

## **Unit XVI**

### **Service robots**

Task 1. Case studies.

#### **At the town council**

The town mayor is considering an opportunity to use driveless cars in his region. He wants to develop the new technology as it will reduce accidents and make traffic flow more smoothly.

The Department for Transport regards that the best and safest way is to trial automated vehicles where an individual is ready to take control of the car if necessary.

But some citizens are worried that the traffic problem will not be solved but even will become worse. That is why they insist on using traditional types of automobiles.

Make up a polylogue and give your reasons.

Task 2. Video.

#### **Service robots**

1. Watch the video and get the necessary information about:
  - the place where the video is shot;
  - the countries which unite forces of the companies and researchers in the field of robotics and automation;
  - what the aim of the exhibition is;
  - what is called the new global technological revolution.

2. Say whether the sentences are true or false about this video fragment.

- a) The action takes place in a Science museum.
- b) Service robots are already part of our everyday lives, and the possibilities for using them are virtually unlimited.
- c) Service robots do not help in housekeeping and to the elderly and sick people.
- d) In an industrial setting professional service robotics is developing fast.

e) In the future international investors will not support smaller companies in their development and marketing smart products of robotics.

**Unit XV**  
**Robots in our future**  
 Task 1. Case studies.

1. Questions for discussion:

- a) What do you think the future will be like?
- b) Will robots replace humans?
- c) Imagine the job you wish to hold when you get older – could a robot be programmed to do that job as well as you?
- d) Will robots be as smart as people? Will they get jobs too?
- e) How will the development of robots change your future?
- f) A film like The Matrix has explored the idea that we might be living in virtual reality. But what evidence is there for or against this hypothesis? And what are its implications?
- g) Do you think we create a new problem with each invention? Think of examples.
- h) What are the positive and negative effects of technology in the future?
- i) Is there anything that does not yet exist that you would like to see invented? What is it?
- j) What is your lifetime dream?

2. Write an essay “What the future will be in 20 years”.

Task 2. Video.  
**Robots of the future**

1. Watch the video and answer the questions:

- 1) What did people dream about robots in the future? Has this future come?
- 2) What is the cream of the joke the robot tells?
- 3) What kinds of robots are shown in the video? What can they do?

4) What kind of robot development do companies invest money in?

2. Fill in the table:

A robot from Toyota	can ...	
ASIMO		
the robot – greeter in hospitals	is used for...	
the seal robot		

## Unit XVI What is Mechatronics?

### Task 1. Video. Mechatronics

1. Watch the video and answer the questions:

- What does mechatronics include?
- What kind of people does modern industry need?
- What do different people say about their work in the field of mechatronics?

2. Fill in the blanks with the missing information.

- a) A manufacturing today is much ... than it was fifteen or twenty years ago.
- b) Industry technicians need ... that cross a variety of boundaries to meet the needs a highly automated manufacturing in the 21<sup>st</sup> century.
- c) Mechatronics professionals have been cross-trained in mechanical, instrumentational, ... robotics, computer components and ... to provide comprehensive solutions for engineering applications. These integrated skills can be applied to a variety of jobs which means students earning a mechatronics degree will have a very

- ...career future.
- d) Tomorrow's industry will use more automated equipment and highly skilled technicians will be needed to keep things running. Businesses and industries need graduates with mechatronic skills and ... abilities.

## **Unit XVIII**

### **Career Prospects in Mechatronics**

#### Task 1. Video.

#### **Career prospects in mechatronics**

1. Watch the video and fill in with the blanks.

Swinburne engineering courses provide students with the knowledge and skills required for ... engineering, computing, electronics and the design and operational mechatronic systems.

Peter Schreiner: We have made a very strong it but to make sure that we have current equipment and stuff in the real subject areas.

Employment opportunities for mechanical graduates include design drafting technicians and sales technical officers. Mechatronics graduates may be employed as ... working with automation or process control systems that use robotics or ... .Well, other career opportunities include design drafting and sales.

Programming robots when back small electronic systems are not also the design on things as well.

Electronics graduates gain a broad background and electronics including photonics, embedded controllers, ... and diagnosis. Potential career opportunities include positions ranging from ... to installation and repair, from design to commissioning. A large amount of work in the electronics field interfaces with .... Monitoring equipment across almost every industry.

For more information read:

1. [www.roboticstomorrow.com](http://www.roboticstomorrow.com)
2. [www.futuretimeline.net/blog/archive](http://www.futuretimeline.net/blog/archive)
3. [www.robonovosti.ru](http://www.robonovosti.ru)
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