Ministry of Public Health of Ukraine
“Ukrainian Medical Stomatological Academy”

**“APPROVED”**
at the meeting of the Department
of Medical Informatics, Medical Biophysics
«27» august 2020
Minutes №. 1 «27» august 2020
Head of department ____________ O.V.Silkova

**METHODICAL GUIDANCE**

for students’ self-directed work when preparing and during the practical session

| | |
|---|---|
| Academic Subject | Medical Information Science |
| Module No 2 | Medical knowledge and decision making in medicine and dentistry |
| Topic | Types of information systems in the health services system. Hospital medical systems and it’s development |
| Year of study | 2 |
| Speciality | Foreign Student Training (Medcine/Stomatology) |
| Number of academic hours | 2 |

**Poltava – 2020**

1. **Relevance of the topic**:

Up to 40% of doctor's working time is wasted on treatment of information about patient, preparation of different documents and reports. Sometimes search of additional information for diagnostics and decision-making can be very important but inaccessible. In these conditions computer use and access to the databases of medical information are necessary for growth of medical practice efficacy.

2. **The specific aims**:

To know

To know definition of medical information systems.

To know technologies of documenting in clinics.

To skill to work with medical information systems.

To understand, to remember and to use the knowledge received;

To form the professional experience by reviewing, training and authorizing it.

3. **Basic knowledge and skills necessary to study the topic (inter-disciplinary integration).**

| Previous (providing disciplines) | **Obtainable skills** |
|---|---|
| Previous (providing disciplines):<br>Informatics bases | To know basic functions and tasks of information storage and retrieval system.<br>To describe them assignment. |
| The subsequent disciplines:<br>Social medicine | To know how to use for necessary information search. |

4. **The tasks for students' individual work**

**4.1. The list of basic term, parameters, characteristics, which student should master while preparin for the class.**

| Term | Definition |
|---|---|
| Information storage and retrieval system | Hardware and software complex for gathering, storage, classification, search on the different attributes, and presentation of data in certain area of knowledge or practice. |
| Medical information system | It is information storage and retrieval systems in the field of medicine and public health care. |

**4.2 Theoretical questions for the class (to the topic)**:

1. Give a definition of new information technologies.
2. Describe a technological scheme of a treatment-and-diagnostic process.
3. Give a definition of medical information systems and them classification.
4. Describe methods of information storage and retrieval system development.
5. Describe network communication role in medical information systems development.
6. Describe MIS levels (Computerized Medical Record System; Electronic Medical Records;Electronic Patient Record ; Electronic Health Record).
7. List features HMIS and IEHMS.

**4.3 Practical tasks pertaining to the topic and to be completed during the class:**

**Test**

1. What is a medical information system?

a) a set of technical equipment, software and service personnel

b) subsystem database of the medical institution

c) software environment
d) various state government institutions
e) a set of systematic medical data for processing using a computer with a purpose
2. How can we characterize MIS?
a) large volume of database;
b) small volume of database;
c) a large volume of knowledge base;
d) a minor volume of knowledge base;
e) none of the above.
3. Information Systems are NOT used in which of the following organisations?
a) Home finance;
b) Educational;
c) Governmental;
d) Health care;
e) Scientific.
4. COMPUTER-BASED INFORMATION SYSTEMS can be described as:
a) Any complicated technology that requires an expert to use.
b) A combination of hardware, software and telecommunications networks that people build and use to collect, create and distribute data.
c) Any technology used to replace or supplement employees.
d) Any technology used to leverage human capital.
e) It is the software that people build and use to collect, create and distribute data.
5. Which of the following is NOT a common type or category of INFORMATION SYSTEMS used in organisations
a) transaction processing systems;
b) decision support systems;
c) enterprise resource planning applications;
d) web-browser applications;
e) digital dashboard applications.

**Content of the topic:**

***Information storage and retrieval system*** *[data retrieval system, data selection system, information retrieval system, information selection system, information select system, retrieval system] – hardware and software complex for gathering, storage, classification, search on the different attributes, and presentation of data in certain area of knowledge or practice.*

Medical informatics is the interdisciplinary science that deals with biomedical information, its structure, acquisition and use. Biomedical informatics is grounded on the principles of computer science, information science, cognitive science, social science, and engineering, as well as the clinical and basic sciences.

*Key research areas include*:

1) understanding how and why researchers and practitioners use information to accomplish their objectives;

2) modeling structures for representing data and information that make relationships between concepts and terms explicit;

3) developing and evolving computer-assisted decision support systems to improve clinical practice, biomedical research, education, and administration;

4) understanding and addressing related workflow, change management, communication, and human-computer interface issues;

5) developing methods for evaluation of models and systems, including health services research, data mining and limiting retrieval to context.

There are two levels of informatics study: professional and user.

***Professional level*** – study of mathematical methods, algorithms of these methods, and programs realized these algorithms, based on detailed study of algorithmic languages.

This level is intended for specialists in applied mathematics, programming engineers and electronics engineers.

***User level*** – user training in ready programs and application package use. There are use of office application software, information retrieval systems (including medical) use, database management systems application, medical expert systems developments and use.

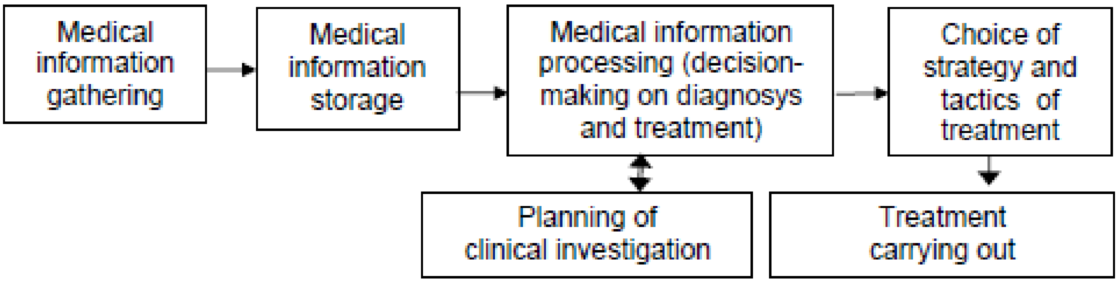


*Fig.1. Technological stages of diagnostics and treatment.*

## INFORMATION TECHNOLOGIES OF SUPPORT OF MEDICAL DOCUMENTATION ON MEDICAL ESTABLISHMENTS (patient care institutions)

The task of the medical information support: registration of the clinical information about all patients on any physical carriers, including results of researches and effects of treatment. In medicine this process is named as support of a case history (an out-patient [ambulatory] card for polyclinic departments).

***Information technologies*** which apply for today to conducting the medical information on the patient at use in clinical practice and in scientific examinations, it is possible to ***categorize*** thus:

***paper, paper-machine, machine technologies.***

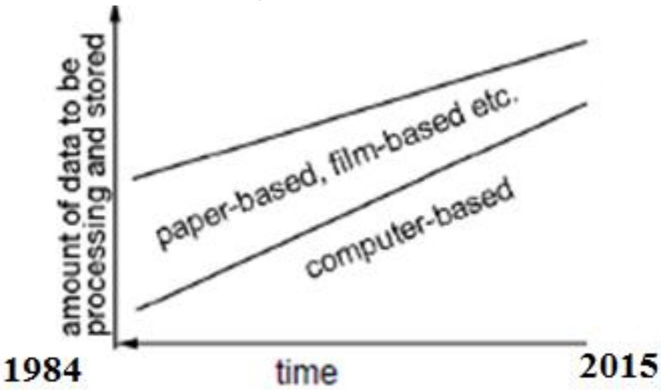


*Fig.2. Roughly trying to visualize the tendency towards computer-based information processing tools, dealing with a steadily growing amount of data in health information systems (by R.Haux).*

The majority of early machine technologies of support of medical documentation use intermediate paper accumulation of the information, therefore they have a title **paper machine.** They allow to carry out the atomized data processing.

Typical example of such machine technology. The case history consists of two parts: **explanatory** and **informative**. The explanatory part has the descriptive information which is not introduced into the computer, and informative part has the information, which is coded by the doctor at filling of questionnaire document, and it is inputted into the computer.

***Advantages of Computerized Medical Records***

7. Simultaneous access from multiple locations;

8. Legibility;
9. Variety of views of data;
10. Support of structured data entry;
11. Decision support;
12. Electronic data exchange and sharing care support.

These records may be available for:

1. Patient care
2. Administration
3. Clinical Audit
4. Financial Audit
5. Research
6. Education

**Consideration of Standards**

Developing an integrated EPR implies dealing with a lot of standards. These include communication standards, data-exchange standards, vocabulary standards, and security standards.

***Medical information systems (MIS)*** is information storage and retrieval systems in the field of medicine and public health care.

MIS classes (in dependence on character of solved tasks): informational-measuring, information retrieval (reference), diagnostic and forecasting, controlling. Any MIS of one class can be used for solution of strictly defined specific tasks. It is possible to use a some different MIS for support of the medical-diagnostic process on any of it stages – for gathering and processing of medical information.

**Medical information system (MIS) levels**

**1 level of MIS** are the atomized medical records. Only about 50 % of the information on the patient is inputted in the computer system; it is used for reports.

**2 level of MIS** is ***Computerized Medical Record*** system. Many medical documents (first of all information from the diagnostic instruments, received as a various sort of listings, scanning images, tomograms and so forth) are brought, indexed, scanned and remembered in systems of electronic storage.

**3 level of MIS** is usage ***Electronic Medical Records***. In medical institution there should be an appropriate infrastructure for input, processing and storages of the information from the workstations.

Electronic medical record can be used in decision-making process at integration with expert systems (at setting the diagnosis, choice of drugs in view of the present somatic and allergic status of the patient, etc.).

On **4 level of MIS** (***Electronic Patient Record Systems*** **= Computer-based Patient Record Systems)** records about the patient have many information sources. All medical information on the patient is included; its sources some medical institutions can be. The nation-wide or international system of identification of patients, the uniform system of terminology, structure of the information, coding and so forth is necessary.

**5 level of MIS** will be electronic record about health (***Electronic Health Record***). It differs from the system of electronic records about the patient existence of practically unlimited sources of the information about health of the patient, including the data on behavioral activity (smoking, occupations by sports, using diets, etc.).

**Electronic medical records (EMRs)** and electronic health records (EHRs) are not the same thing. The acronyms represent entirely different concepts, so insisting that they're used correctly is more than quibbling over words.

EMRs are computerized legal clinical records created in care delivery organization (CDOs), such as hospitals and physician offices. EHRs represent the ability to easily share medical information among stakeholders and to allow it to follow the patient through various modalities of care from different CDOs.

Definitions:

– **EMR:** An application environment composed of the clinical data repository (CDR), clinical decision support system (CDSS), controlled medical vocabulary (CMV), computerized provider order entry (CPOE), pharmacy and clinical documentation applications. The patient's electronic record is supported across inpatient and outpatient environments; is used by healthcare practitioners to document, monitor and manage care delivery within the CDO; and is owned by the CDO. The data in the EMR is the legal record of what happened to the patient during encounters at the CDO.

– **EHR:** A subset of each CDO's EMR, presently assumed to include summaries, such as ASTM's Continuity of Care Record (CCR) and HL7's Care Record Summary (CRS), and possibly information from pharmacy benefit management firms, reference labs and other organizations about the health status of patients in the community. It contains patient input and access spanning episodes of care across multiple CDOs within a community, region, or state (or in some countries, the entire country). The patient controls access to information. In the United States, EHRs will ride on the proposed National Health Information Network (NHIN).

Really in the near future usage of 1-3 systems of levels will be, in a number of locales - 4 level will be.

Local networks, which now are very easy and cheap, substantially broaden possibilities of computer technologies. Them porting to territorial networks and Internet strengthen possibilities, but lead to appearance of new serious problem – data safety and protection from illegal access.

**Prospects of MIS development**

Modern development of MIS is based on possibilities of networks and Internet considerably.

One of primary possibilities, which is accessible for every doctor, is Internet retrieval systems and Internet medical databases.

Others are realized in different countries correspondingly to the locate possibilities.

**HMIS and IEHMS**

Most power future version of MIS is them development into HMIS (*health management information systems)* and IEHMS *(integrated emergency, healthcare and medical information system).*

The **World Health Organization (WHO)** argues that investment in ***health management information systems (HMIS)*** now could reap multiple benefits, including:

• helping decision makers to detect and control emerging and endemic health problems, monitor progress towards health goals, and promote equity;

• empowering individuals and communities with timely and understandable healthrelated information, and drive improvements in quality of services;

• strengthening the evidence base for effective health policies, permitting evaluation of scale-up efforts, and enabling innovation through research;

• improving governance, mobilizing new resources, and ensuring accountability in the way they are used.

**Integrated emergency, healthcare and medical information system (IEHMS)**

The Integrated Emergency, Healthcare, and Medical Information System (IEHMS) will be developed in the web-based multimedia environment, mobility and real-time technology.

The system provides an integrated medical database, which can provide stakeholders with related medical information.

The registered users can log into the system to access or provide medical information based on their accessing privilege. The medical information can be stored in a variety of multimedia forms such as video, audio, pictures and text.

room.

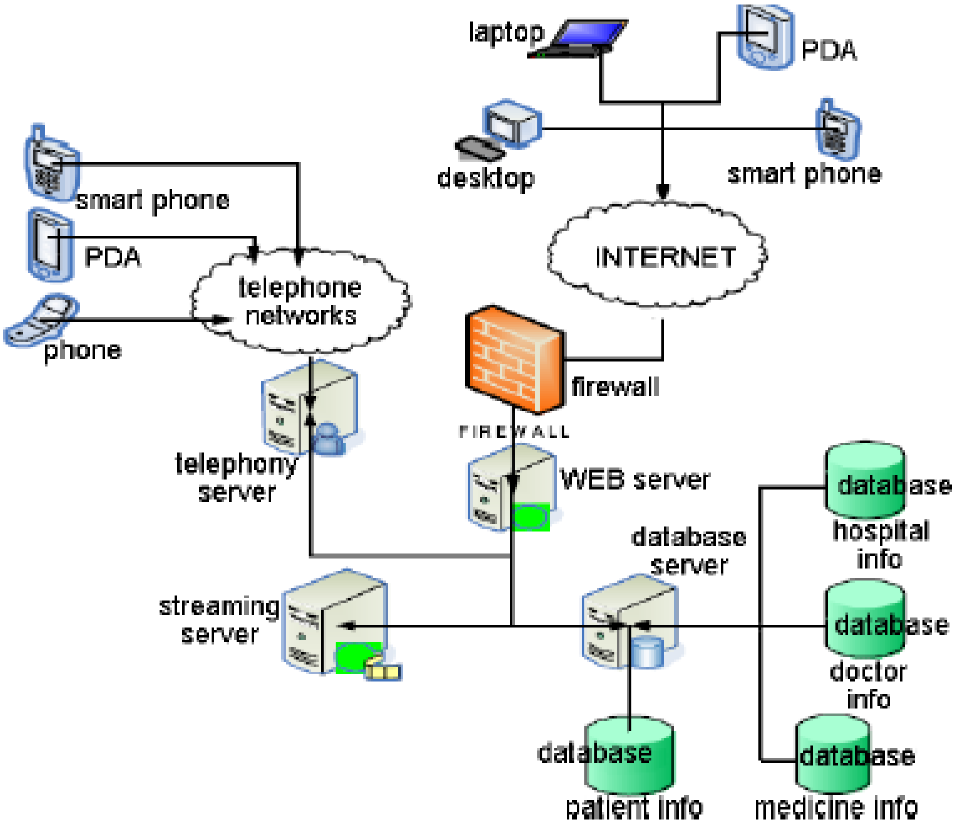


*Fig.3. Overall IEHMS architecture (by Shihab A. Hameed and others).*

## INDIVIDUAL MEDICAL CARDS. STRUCTURATION OF THE MAINTENANCE OF ELECTRONIC MEDICAL CARDS

The Oxford Textbook of Primary Medical Care describes medical records as “the information that exists about a patient in a medical service”. Record keeping assists doctors by retaining and communicating patient medical history in a portable, convenient format. Relevant information must be quickly available to allow rapid, effective decisions and reduce unnecessary repeat procedures. The natural medium with which to record medical history is paper, since it is simple to use, low in cost, and reasonably durable. Information may be quickly added and readily shared amongst health professionals caring for a patient. However, problems arise due to the decentralized nature of the healthcare system; patients frequently visit different offices for dental work, cardiology, and primary care, impeding the necessary flow of medical information. Fragmented, incomplete patient records pose an obstacle to patient care. It is generally agreed that administrative costs are a serious burden, and changes that can alleviate these costs are desirable. An electronic medical records system has the potential to solve the problems of traditional paper records. The concept of keeping electronic records has existed for nearly 50 years. As Dr. Henry J. Lowe from Stanford School of Medicine reports, institutions have experimented since the 60s and 70s with various forms of electronic recordkeeping. Examples of early electronic systems include Computer-stored Ambulatory Record (COSTAR), Health Evaluation through Logical Processing (HELP), and Multiphase Health Testing System (MHTS).

Today, medical records are being kept in a variety of formats ranging from folders in cabinets to modern electronic databases. It is common to see computers in healthcare facilities, where many instruments are electronic. A June 2008 study by the non-profit Healthcare Information and Management Systems Society reports that over half of all hospitals have a form of electronic clinical documentation or a data repository. However, this same study notes that about 20% of facilities are at the most basic form of IT usage, and no facilities have reached fully electronic records. The majority of healthcare providers continue to use the traditional paper based records system. This system has existed for longer than most of our doctors have practiced medicine, and professionals are accustomed to it. The current system is built to maximize patient privacy issues and accountability. The only substantial recent change in criteria is HIPAA, and traditional records are commensurate with this because they are portable (faxable, can be copied), private (lockable, only allow authorized individuals access), and accountable (conspicuous when tampered). Since paper records are already in place, the status quo is inherently the most feasible of alternatives and requires no action. The problem with the current system lies in the lack of efficiency. Because records are stored in so many formats, and because patients often go to more than one provider, records are often fragmented and the transfer of information between providers is limited. The fragmentation of information leads to higher risk of medical errors, duplicate procedures, and time wasted obtaining information.

A system of electronic health records provides an infrastructure where all medical records are digitized, then stored and transferred electronically. Popular companies' vendors are fond of publishing reports in favor of using electronic medical records and some like Hewlett-Packard even offer to have lunch with healthcare directors to advertise their products. Big names like Google or Microsoft have offered to handle all the logistics and security. With bipartisan support in congress and the support of industry to digitize patient records, this measure has high political feasibility. Supposing there was a way to instantly switch to interoperable electronic records, the most evident change reflected on the system would be greatly increased efficiency of recording and transferring data. A valid concern is that working with data would be easier for not only legitimate users but also malicious users. Fortunately, security technology is sufficiently strong, protecting sensitive transactions such as bank transfers, all electronic since 2004, and US ecommerce, which rose over $175 billion in 2007. Thus, privacy and accountability are ensured as long as users practice good habits. In regards to cost impact, the $19 billion ARRA package suggests that the government has faith that electronic records will benefit the economy. The only remaining question is integration, a key part of feasibility, because organizations will likely adopt electronic systems at different times. The current process healthcare providers must undertake to transition to electronic records is long and arduous. An institution needs to select a desirable electronic record system, install information technology infrastructure, train users, and migrate data. An enormous task in itself, transitioning is further impeded by lack of coordination among other institutions. Paper records will exist at least until 2015, the deadline set by ARRA. The need to collaborate with different healthcare services creates roadblocks when patient data systems are incompatible. An article in the American Health Information Management Association's journal is aptly titled "Record Limbo: Hybrid Systems Add Burden and Risk to Data Reporting". A fully electronic system readily functions within an institution, but causes inefficiencies when dealing with incoming or outgoing information. As such, the electronic-paper connection is necessarily preserved; managing this burden is key to adopting digital records. Even amongst electronic systems the existence of over 38 different record systems surely impedes information flow.

An electronic medical information card for storing an individual's emergency medical information on. The medical information card is stored in a storage sleeve to attract the attention of medical personnel. The storage sleeve may be removably attachable to a user's driver's license, wallet, purse and so forth so that it may be easily seen by a first responder. In addition, the storage sleeve is water proof and fire resistant to protect the electronic medical information card from becoming damaged. The information on the electronic medical information card may be updated by an individual over the internet by sending updated information to a central location that updates the information in a central database and allows the user to download the updated information back onto the electronic medical information card.

## BACKGROUND OF THE INVENTION

This invention relates to providing personal medical information to first responders during an emergency through the use of electronic storage devices and the internet.

During a medical emergency, time is of the essence for a patient to receive the proper care from first responders. In such instances it is important that first responders are aware of a patient's medical history including allergies to drugs, current medications and medical conditions. It also becomes necessary to have the patient's emergency contact information and physician contact information. In many instances patients are unconscious and unable to provide any information to first responders. Conventional methods of providing such information include medical identification bracelets which may list an individual's allergies or medical conditions. However, only a limited amount of information can be included on such bracelets. There have also been attempts to store an individual's medical information on electronic storage devices such as flash drives or radio frequency identification cards (“RFID”) in the past. However, many of these devices are complicated to use and to store information on. In addition, many of these devices are carried in wallets or on key chains and can easily be missed by a first responder. In addition, such devices may be damaged in certain situations, such as if the devices become wet during a medical emergency involving water or if the devices are near flames. A further problem with conventional devices occurs if an individual is injured in a foreign country, thereby rendering the electronic storage device useless because the information stored on the device is not written in the first responder's native language.

Therefore, the need exists for a personal medical information card and system and method of use that allows a user to easily store medical information on the card, has a card that is easily identifiable by a first responder as being a medical information card, is protectable from water and fire and allows a foreign language speaking first responder to read the information stored on the card.

## SUMMARY OF THE INVENTION

The primary object of the present invention is to provide an electronic medical information card and system and method of use that allows a user to easily store personal and medical information on the card.

Another object of the present invention is to provide an electronic medical information card that is easily identifiable by a first responder as being a medical information card.

An additional object of the present invention is to provide an electronic medical information card and system and method of use that protectable from water and fire.

The present invention fulfills the above and other objects by providing an electronic medical information card for storing emergency medical information, such as blood type, allergies, medical conditions, present medications, age, doctor information and emergency contact information. The card is preferably a secure digital (“SD”) card or other electronic smart card having an electronic storage means. The card is stored in a brightly colored storage sleeve to attract the attention of medical personnel. The sleeve is removably attachable to a user's driver's license, wallet, purse and so forth so that it may be easily seen by a first responder. In addition, the storage sleeve is water proof and fire resistant to protect the electronic medical information card from becoming damaged. The information on the electronic medical information card may be updated by an individual over the internet by sending updated information to a central location that updates the information in a central database and allows the user to download the updated information back onto the electronic medical information card. An additional feature of the card allows a first responder to translate the information stored on the electronic medical information card into the first responder's native language.

## Tasks for self-check:

**Task 1:**

1. WHICH OF THE FOLLOWING STATEMENT ABOUT MEDICAL RECORDS (MR) IS TRUE?

a) Usually, a medical record is organized in terms of the temporal sequence of events with the latest admission located at the front of the medical record.

b) While patient identification, geographical information, and medical history are contained in most medical records, treatment and follow-up reports are not.

c) A medical recerd provided by an independent vendor does not need to have policies on privacy and security.

d) All hospitals follow the same procedures for organizing a medical record.

e) The personal health record is synonymous with the medical record for all facilities.

2. THE BENEFITS OF A PERSONAL HEALTH RECORD INCLUDE:

a) Improved patient safety

b) Better healthcare information managment

c) More informed consumers

d) All listed answers are right

e) Using digital media to store this data

3. WHAT MEANS CONTINUITY OF CARE RECORDS (CCR)?

a) It is the computer-based documentation of a patient's medical history and care.

b) It is is a medical record in digital format.

c) It is a systematic documentation of a patient's medical history and care.

d) It is meant to represent a brief synopsis of recent healthcare encounters, to include only significant data.

e) It is the medical information that is in the possession of an individual patient. The format may be paper documents, electronic media, or a combination of both.

4. WHICH DATA STORAGE SYSTEM MODEL CAN BE USED TO SATISFY SYNCHRONIZATION OF RECORDS PROBLEM IN ELECTRONIC HEALTH RECORD SYSTEM?

a) Centralized data server or peer-to-peer networks.

b) The Ethernet network.

c) Centralized data server.

d) Desktop datanase management system.

e) Network with Mesh or Token Ring topology.

5. WHICH ARE IDEAL CHARACTERISTICS OF AN ELECTRONIC HEALTH RECORD?

a) Information should be able to be continuously updated.

b) All listed answers are mutually complementary.

c) The data from an EHR system should be able to be used anonymously for statistical reporting.

d) It is must be possible to exchange records between different EHR systems.

e) EHR system must support storing and retreiwing all kinds of the patient's medical data.

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**Basic.**

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**Additional**.

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The methodical guidance has been completed by **S.Y. Olenets**