



Continuing Professional
Development
in Vocational Education

Unconventional Machining Methods

2

Inspiration for online teaching



In the COVET project, we have collected many great examples of teaching that have been transformed from the classic off-line version into a modern online learning method.

These sample lessons have been created by VET teachers from different EU countries. We present them to you as inspiration for your work.

The lessons are particularly suitable for vocational teachers, but can also serve as a training tool for teachers, trainers and lecturers in other educational settings.

All sample lessons, training materials as well as all information about the project are available at:

<https://www.covet-project.eu/>

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Unconventional Machining

Methods 2

(9 lessons) – combining online and face-to-face teaching

3rd year of a four-year course with a secondary school leaving exam

Off-line version of the preparation

Goal

Students will be able to list all methods of unconventional machining. They can outline and explain the principle of each of these methods of machining of materials. They can compare the advantages and disadvantages of unconventional machining methods with conventional machining methods. Recognise and explain the advantages and disadvantages of each of the unconventional machining methods.

Teaching methods

explanation, problem-based interview, animation, use of three-dimensional aids, drawing diagrams and other activities depending on how the lesson goes

Aids

Products machined by individual unconventional machining methods, tools for EDM, nozzle for laser machining

Presentation: diagrams of unconventional machining principles, links to animations or videos, photos of the working area of machines and tools, photos of products for each individual unconventional machining methods

Teaching notes summarising the learned material. These will be handed out after the lesson is over.

The course of activities in the lesson

- Explaining the advantages and disadvantages of conventional and unconventional machining methods - problem-based interview
- In each of the total of nine lessons the teacher provides an explanation and a problem-based interview for each single method of unconventional machining
- Drawing of relevant simplified diagrams is required from the students
- Distribution of printed teaching material summarizing content of each individual lesson. The students can also make notes but as this is a rather difficult topic it is good to have materials from the teacher available.
- How did each individual lesson go? The students will be asked to provide feedback on what and whether they managed to learn.

A sample of several slides from the PPT presentation. Videos and animations are absolutely necessary in order to understand the principles and differences of these methods.

Charakteristické rysy :

- ❖ lze obrábět **nejpevnější a nejtvrdší materiály**
- ❖ působí **nepatrné (nebo žádné) fyzické síly**
- ❖ na obrobek působí **nepatrné (nebo žádné) teplo**
- ❖ lze obrábět **nepatrné rozměry i velké plochy**
- ❖ vysoká **energetická náročnost**
- ❖ **objemový výkon** procesu obrábění je zpravidla **velmi malý**

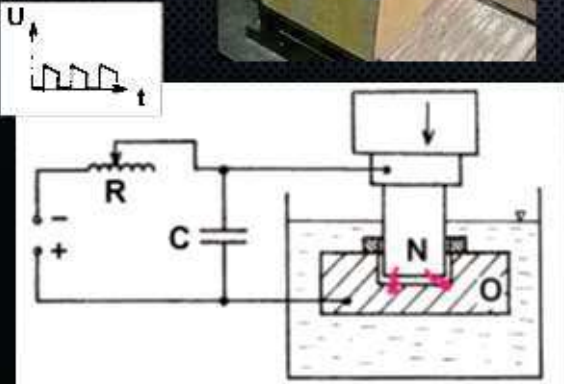
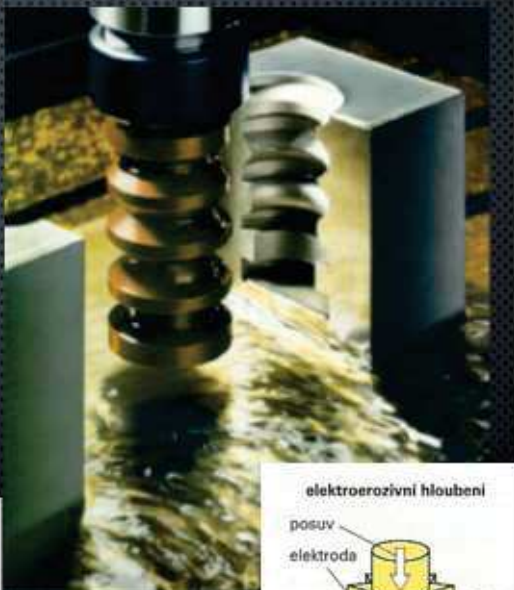
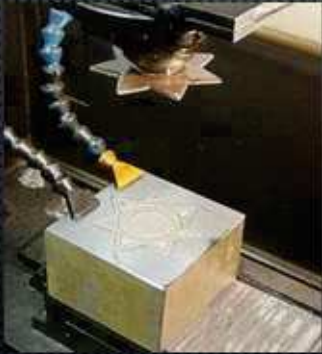


ROZDĚLENÍ:

- **obrábění elektrickým výbojem:** elektroerozivní obrábění elektrickou jiskrou a elektrickým obloukem;
- **obrábění chemické:** elektrochemické a chemické obrábění;
- **obrábění paprskem koncentrované energie:** obrábění laserem, plazmou, elektronovým a iontovým paprskem;
- **mechanické procesy obrábění:** obrábění ultrazvukem, kapalinovým paprskem a proudem brvy.



Elektrojiskrové negativní kopírování tvaru nástroje



elektroerozivní hloubení

posuv elektroda

obrobek

Online version of the preparation

The absence of students speaks for the use of online distance learning (whether just placed somewhere online by a teacher or using LMS systems) even in times when there is no threat of long-term school closure. During viral epidemics, sometimes only 5 out of 25 students are in class. Some students also have longer-term or long-term illnesses. Being able to use a distance learning course where everything is explained and the knowledge gained can be immediately tested and stored in long-term memory is very important for the students. As this is a topic included in the final exams I decided to prepare the course and make it available for students throughout the entire school year. Anyone can use it and have an advantage of storing information in their long-term memory using the **method 1-2-7-12** (A method based on short-term and long-term memory studies. You should store an information in your long-term memory if you study on the 1st, 2nd, 7th and 12th day from learning about it. Not every student is willing to do so, however I introduce it to my students and they have an option to use it.) Another advantage of distance courses is that students with a slower pace can use them and if they do not manage to catch something in school they can learn and practice using such online materials.

Further great advantage of such an online course is that the student can start the course when he/she has the best time and condition to learn. It also provides the students with an immediate feedback. There are also videos available in this course where you can see from inside of the machine how the tools work (one cannot see this process in practice, as the machines have protective covers), etc. It is not possible to watch all the videos in class due to time constraints.

The disadvantage of such a course is the absence of a teacher who could respond immediately to any ambiguities. This can be remedied to some extent by students asking questions via Teams (and any other sent channel of communication) or in the face-to-face class.

I have created an educational course Unconventional methods of machining in the iTrivio LMS system. It is divided into individual subsections containing an explanation of a certain part of the taught material (a single unconventional machining method) and an immediate practice (self-assessment test, quiz). If students are still **uncertain about anything they can write questions to my chat in Teams**. When I'm not teaching, I can answer them or join them in a video call and share the screen.

Excerpts from the distance course



MS3A 22/23 9 NEKONVENČNÍ METODY OBRÁBĚNÍ - vzdělávací a cvičný kurz

Je to kurz pro pochopení principů jiných metod obrábění než je klasické třískové obrábění.

Není nastaven žádný detailní popisek.

Počet stránek: **41** (z toho navštíveno 0)

Počet povinných stránek: **0** (z toho navštíveno 0)

Čas strávený studiem: **0 min 0 s**

Zavřít

Spustit

Obsah <<

4.1. Jaký je princip obrábění elektroerozivní metodou?

4.2. Dielektrická kapalina musí být (zatrhněte 3 správné odpovědi):

4.3. Dielektrickou (nevodivou) kapalinou může být

4.4. Elektroerozivní (elektrojiskrové) obrábění se nejčastěji děje

5. NEKONVENČNÍ METODY OBRÁBĚNÍ - prezentace v PP

▶ 6. OBRÁBĚNÍ PAPSKEM PLAZMY

▶ 7. OBRÁBĚNÍ LASEREM

8. OBRÁBĚNÍ VODNÍM PAPSKEM

▶ 9. ŘEZÁNÍ VODNÍM PAPSKEM

Dielektrickou (nevodivou) kapalinou může být

- deionizovaná voda,
- petrolej,
- vodní sklo,
- solné roztoky
- rtuť
- jakákoli voda
- destilovaná voda protože je nevodivá

Aja, to mně boří!!! **0 bodů**



Obsah

- 7. OBRÁBĚNÍ LASEREM
- 8. OBRÁBĚNÍ VODNÍM PAPRSKEM
- 9. ŘEZÁNÍ VODNÍM PAPRSKEM
- 10. OBRÁBĚNÍ ULTRAZVUKEM
- 11. OBRÁBĚNÍ ELEKTRONOVÝM PAPRSKEM
- 12. OBRÁBĚNÍ ELEKTRONOVÝM PAPRSKEM - VIDEO

12.1. Který následující výrok správně vystihuje definici obrábění elektronovým paprskem?

Svařování elektronovým svazkem

Zde je vidět svařování elektronovým paprskem, ale obrábění probíhá v podobných zařízeních.

<https://youtu.be/ZdCww4WTyBw>

The course of teaching has therefore changed as follows:

- Explaining the advantages and disadvantages of conventional and unconventional machining methods - problem-based interview. This can be done in class or online using the tutorial.
- In each of the total of nine lessons the teacher provides an explanation and a problem-based interview for each single method of unconventional machining
- Drawing of relevant simplified diagrams
- **Making the tutorial available to all students, using it is especially recommended to those who are absent or for some reason failed to understand everything.**
- Distribution of teaching material – can be done in class or sent to students
- You discuss how each individual lesson went.
- **Later, answer questions in the Teams chat.**

Feedback on the lesson

As the course was available to the students over the entire school-year it improved the chance of them actually succeeding in their finals. As I explained the 1-2-7-12 method to my students they were sceptical at first however, later on some of them reported to me that they had started using it even in other subjects. The great advantage of such an online course is that it can be done anytime and anywhere. If an Internet connection fails, you can still take it later on.



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