13. Electronic components: capacitors

Title	„Electronic components: capacitors. What it is used for and how it is made"
Content/Subject areas	Subjects: Physics, engineering, constructing, technologies, art. Topics: Electric charge, Working principles of capacitors, Areas of use, Demonstration of charging and discharging capacitors, Technology of capacitor manufacturing, Practical work.
Target group	Age: 16-20 years old students, preferable size of group: 5 persons
Learning objectives / competences	To get a knowledge about one of the most basic and essential elements in electrotechnics and electronics – the capacitors. Competences: - Mathematical competence and basic competences in science and technology, - Problem solving, - Critical thinking, - Creativity, - Learning to learn.
Description of overall activity	Basically whole learning process consists of two parts: theoretical and practical. Theoretical part gives overall knowledge and the practical part strengthens the acquired knowledge. All subject areas are placed in order that gives the best way of acquiring information of subjects. During activity students create one of the most modern electrical engineering major components - a capacitor. This activity provides a deeper understanding of capacitor's structure and shows the possibility to produce this kind of detail independently.
Description of the process and teaching/ learning strategies used	At first, the students get to know the use of capacitors, the structure, the characteristics of capacitors and the things that affect them. The second part of classes starts with practical work where students by themselves make fully operational radio detail - capacitor by using everyday things which can be practically used in different constructions. For the practical creation of capacitor it is not necessary to have complicated equipment - it is one of the pluses of such activity. The simplest version of the required materials includes - wires, aluminium foil, paper, adhesive tape. Tools: scissors, clipper, multimeter with capacitance measurement function. From aluminium foil and paper there are cut two or more electrodes / plates and insulators that overlap each other and are fastened by adhesive tape. The main condition for a successful outcome is to prevent the contact of aluminium plates with each other. The manufactured capacitor's capacity or in simpler terms: charge capacity depends on the size of boards and their proximity to each

	other. During the activity students even organized a competition- who will set up a capacitor with the greatest capacity. Benefits: increased understanding of the capacitor's' construction, construction solutions, as well as students' awareness that they by themselves can create something that might encourage for further experiments.
Evaluation/ types of assessment	Evaluation includes results of both – the test and practical work results.
Materials and tools	Personal computer, projector for presentation of theoretical materials. Different types of capacitors, laboratory power supply, multi meters with capacitance meter, ammeters, voltmeters, connection wires), LED or light bulbs (6V), aluminium foil, paper, wire material, scissors, pliers. For best results for demonstration and practical work there can be used electronic kit of multi vibrator circuit.
Timing and learning environment	Timing- approx. 3-4 hours. Environment- classroom or laboratory with required equipment.
Conclusion	Main innovation here is practical work - hands on activity which makes the best results of acquiring all the topics of different subjects related to capacitors, including technology of manufacturing, electrical parameters of capacitor, things that change these parameters (area of electrodes, isolator materials between capacitor plates, and so on).
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