BEM Micro-credential

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| **BEM content (for all partners)** | Micro-credentials title | **Microcontroller programming for traffic information systems** |
| Micro-credentials purpose | The purpose of the microcredential program is to gain knowledge about microcontrollers, their features and applications. Training for design and performance analysis of devices based on microcontrollers. Real-timemicrocontroller programming training. |
| Target groups (to whom is intended) | Employees in production companies who want to be further educated, unemployed, people who want to retrain. |
| Sector | Electronics industry |
| Area(s) of Application/Operating Environment | Industry, transportation etc. |
| Typical Jobs/Work Assignments | Creation of digital circuits and firmware; assembly preparation and subsequent approval; change and support of the existing firmware; examination and correction of possible errors in the operation of the microcontroller; production support andparticipation in various types of tests. |
| Learning outcomes (professional and key competencies) | Knowledge:* Defines the term microcontroller;
* Explain the programming procedure of a modern microcontroller;
* Describes the microcontroller ports.
* Explain the software development environment;
* Distinguishes data types and uses them;
* Explain the programming and reprogramming procedure of a microcontroller;
* Differentiates the types of digital outputs;
* Differentiates work with digital sensors.
 | Skills:* Uses program modules;
* Use libraries of built in functions;
* Uses language structures;
* Transfers firmware from the computer to the microcontroller;
* Manages analog inputs (reading analog sensor values);
* Uses pwm – pulse- width modulation;
* Connects the elements of the microcontroller system according to the attached diagram;
* Models a simple microcontroller system with different types of sensors and actuators;
* Connects the system to the computer and transfers data to and

from the computer. | Key competencies* Development of a simple system with a microcontroller;
* Connects the system to the peripherals (Display with LED diodes, LCD displays, touch-sensitive displays, digital and analog sensors)
* Firmware testing and changing;
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| Check | *Criteria** suitability - reliability; (compliance of the assessment with established, public and precise assessment

criteria); | *Procedures** formation of the examination

committee; |

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|  |  | * validity; (evaluation shows the effects of learning - achievement of results, engagement and progress of participants;
* diversity of assessment methods: (choice of appropriate and application of different assessment methods and techniques in order to ensure validity, reliability and objectivity of assessment);
* evaluation without discrimination and selection on any basis;
 | * determining the list of tasks for the exam;
* extracting work tasks;
* checking competence by creating tasks;
* examination records;
* awarding of certificates;
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| Recognized/Accepted by (Confirmed byMemorandum of Understanding) | Company name:*Johnson Electric d.o.o. Nis, Serbia DMV Control Systems, Nis, Serbia* |
| Organizers of training and development | JPOA / Publicly recognized organizers of adult education programmes |
| **Additional information (if applicable)** | Requirements for attending training | Level 3, i.e. level 4 of NQFS (National QualificationsFramework In Serbia), obtained by completing a three-year, i.e. four-year secondary vocational education on educational profiles in the field of mechanical engineering and metalworking or the field of electrical engineering.Training duration 125 hours |
| Recommended training duration |
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|  |  | Informal training |
|  | Place in existing |  |
| **Detailed** | educational programs |  |
| **content** |  |  |
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|  | Reference to the national | 4th level of National Qualifications Framework In Serbia **(**NQFS) ; 4th level |
| **(national, if** | qualification framework | European Qualifications Framework (EQF). |
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| **applicable)** |  |  |
|  | Number of credits | 5 |