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-time  microcontroller 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 and  participation 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; |
| 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; |
| Recognized/Accepted by (Confirmed by  Memorandum 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 Qualifications  Framework 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 | |