

STATEMENT

on the competition for awarding the academic position "Associate Professor"
in area of higher education: "5. Technical Sciences"
professional field "5.2. Electrical engineering, electronics and automation",
specialty "Application of the principles and methods of cybernetics in different fields of science
(biomedicine)"

announced in SG 69/16.08.2024

Candidate: Chief Assistant Professor Tatyana Dimitrova Dobreva, PhD

Member of the scientific jury: Prof. Irena Ilieva Jekova, PhD
from the Institute of Biophysics and Biomedical Engineering - BAS

Chief Assist. Prof. Tatyana Dimitrova Dobreva is the only candidate in the competition for the academic position of "Associate Professor", published in the State Gazette No. 69 of August 16, 2024. The presented set of materials has been prepared in accordance with the Law on Academic Staff Development in the Republic of Bulgaria (LASDRB) and the Regulations for its application at the Institute of Biophysics and Biomedical Engineering (IBPhBME) at the Bulgarian Academy of Sciences (BAS). The presented set of materials contains all the necessary documents for participation in the competition.

1. General characteristics of the research and applied research activities of the candidate

Chief Assistant Tatyana Dobreva defended her PhD thesis in 2003 on the topic: "Fast recovery of an electrocardiographic amplifier after a defibrillation pulse". She has 29 years of work experience in the field of the competition, including 12 at the Central Laboratory of Biomedical Engineering – BAS, and 14 at IBPhBME -BAS.

To participate in the competition for the academic position of "Associate Professor", the candidate has submitted a total of 38 publications, including 20 papers indexed in the scientific databases Web of Science (WoS) or Scopus (8 papers with impact factor (IF), 6 papers with SJR rank, 6 papers without IF/SJR) and 18 not indexed papers. Some of the not indexed papers are included in proceedings of international and national scientific forums. Chief Assistant Tatyana Dobreva is the first author in 8 of the publications. A list of 258 citations of 36 publications is presented, which is an evidence for the value of the achieved results. The candidate has indicated a participation in an international contract with Schiller AG, Switzerland, and an ongoing contract with the Bulgarian Scientific Research Fund. Evidence for the scientific and applied focus of the research conducted by Chief Assistant Tatyana Dobreva are the two patents presented, which are valid on the territory of Bulgaria, as well as the certificate for implementation from Schiller AG, Switzerland.

The analysis of the candidate's research and applied scientific activities (summarized in Table 1) shows that the achievements of Chief Assistant Tatyana Dobreva significantly exceed the minimum national requirements for the academic position of "Associate Professor", as well as the requirements specified in the Regulations for the application of the LASDRB at IBPhBME - BAS.

Table 1. Comparison of the candidate's points with the minimum national requirements for the academic position of "Associate Professor".

Group of indicators	Indicator	Minimum number of points for "Associate Professor"	Candidate's points
A	1. Dissertation paper for awarding educational and scientific degree "Doctor"	50	50

C	4. Habilitation work – science publications (not less than 10) in editions referenced and indexed in world renowned databases with scientific information	100*	189
D	7. Science publication in editions referenced and indexed in world renowned databases with scientific information 8. Science publication in not referred journals with scientific reviewing or in edited collective volumes	200*	311
E	12. Citations or reviews in science editions, referenced and indexed in world renowned databases with scientific information or in monographs and collective volumes	50	100
F	26. Recognized application for a useful model, patent or copyright certificate	-	80

* According to the Regulations for the application of the LASDRB at IBPhBME – BAS, the candidate must have at least 8 articles in journals with IF, which could be distribute between criteria C4 and D7. The materials presented by Chief Assistant Tatyana Dobreva meet this criterion.

2. Main scientific and applied contributions

I accept the contributions formulated by Chief Assistant Tatyana Dobreva, which are in the field of development of hardware and software tools for acquisition, generation and filtration of various biosignals – mainly electrocardiographic (ECG). They are scientific-applied and applied contributions and can be summarized as follows:

- Innovative circuit solutions for acquisition and recording of biosignals have been proposed, including: (1) Differential and non-differential amplifiers without a reference electrode, applicable for two-electrode recording of ECG signals; (2) An amplifier with current-controlled inputs, providing low common-mode impedance of the current electrodes and high differential impedance of the voltage electrodes, which is applicable for simultaneous recording of high-quality ECG and respiration measured by bioimpedance; (3) Measuring transducers for acquisition of biosignals from sensors with capacitive output impedances, which enable ECG recording via capacitive electrodes; (4) 16-channel ECG acquisition module with 24-bit amplitude resolution and 2 kHz sampling rate; (5) photo-transducer for registration of peripheral pulse from the forehead area. A method and device providing better suppression of the offset and low-frequency noise of the measuring transducer via correlated multiple sampling have been implemented and patented. This summarized scientific-applied and applied contribution is supported by 3 publications from group C, 8 publications from group D and one patent. The publications have been cited a total of 93 times.
- An ECG simulator that complies with the international standard IEC 60601-2-47 has been developed. The simulator generates high-resolution signals through direct digital-to-analog conversion of data from a computer. The ECG simulator is described in one publication from group C, which is cited 2 times.
- Adaptive low-pass filters based on the “Savitzky-Golay” approximation procedure with dynamic change of the cutoff frequency, as well as locally adaptive algorithms for “myriad” filters with adaptation of a linearity parameter have been designed. The application of the "Savitzky-Golay" filter is demonstrated both for suppressing electromyographic (EMG) interference in ECG signals and for obtaining a clean EMG signal. This filter has been implemented in “CS-200 Excellence” ECG devices (Schiller AG, Switzerland) in serial production, for which a certificate of implementation has been issued. The developments related to the designed adaptive low-pass filters

are described in 2 publications from group C and 3 publications from group D, which have been cited a total of 57 times.

- Solutions for suppressing power-line interference in ECG have been proposed, including comb filters with controllable Q factor, and filters based on synchronous filtering. The latest include: (1) mixed analog-digital solution for automatic balancing of electrode impedances and amplifier input impedances; and (2) digital filter with synchronous filtering, based on synchronous processing of the differential and common-mode input signals. The comb filters are described in 7 publications from group D, while the filters based on synchronous filtering are presented in 3 publications from group C and 6 publications from group D. The total number of citations of publications related to this contribution is 39. The synchronous filter is protected by a national patent.

I consider that the candidate's participation in achieving the formulated contributions is significant, taking into account the number of publications, in which Chief Assistant Tatyana Dobрева is first (8) or second (26) author. In support of the candidate's significant contribution is the fact that only 7 of the publications (18%) have more than three co-authors.

3. Significance of the contributions to the science and practice

The contributions noted above, which are based on the candidate's research and applied science activities, support the acquisition, recording and pre-processing of ECG and other biosignals. The significance and relevance of the created methods and devices is undeniable, which is also confirmed by the number of citations found. The presented certificate for implementation shows the applicability of some of the presented developments in practice.

4. Critical remarks and recommendations

I have the following recommendation to Chief Assistant Tatyana Dobрева:

- To focus on publishing the results of her research in journals with an impact factor and open access.
- To engage herself in participation, and subsequently in leadership, of scientific projects funded by national and international programs.

CONCLUSION

Considering the materials presented by Chief Assistant Tatyana Dobрева and assessing the significance of the presented scientific papers and the scientific and applied contributions contained in them, I believe that the candidate meets the minimum national requirements and the requirements for holding the academic position of "Associate Professor" announced in the Regulations for the application of the LASDRB at IBPhBME – BAS. Based on this, I find it reasonable to propose Chief Assistant Tatyana Dobрева, PhD, to take the academic position of "Associate Professor" in professional field "5.2. Electrical engineering, electronics and automation", specialty "Application of the principles and methods of cybernetics in different fields of science (biomedicine)", at the Department "Processing and analysis of biomedical signals and data" in IBPhBME – BAS.

Date: 18.11.2024

Member of the scientific jury:

(Prof. Irena Jekova, PhD)