STATEMENT

by the competition for an academic position **Associate Professor**,
Area of higher education: 5. "Technical Sciences",
Professional Field 5.2. "Electrical engineering, electronics and automation",
Scientific specialty „Application of the principles and methods of cybernetics in different fields of science (biomedicine)", for the needs of the department „Analysis and processing of biomedical signals and data" in the Institute of Biophysics and Biomedical Engineering (IBPhBME) – Bulgarian Academy of Sciences (BAS), announced in the State Gazette (issue no. 58/18.07.2025).

The only candidate for the competition is **Dobromir Petkov Dobrev**, PhD, Chief Assistant Professor in the same department.

Internal member of the scientific jury, appointed by order of the director of IBPhBME-BAS (no: 631/01.08.2025) is **Prof. Vessela Tzvetanova Krasteva PhD, MSEE**.

1. General Characteristic of the Scientific and Applied Research of the Candidate

For participation in the announced competition, the candidate Chief Assist. Prof. Dobromir Dobrev has submitted the necessary documents for scientific research, which fully comply with the minimum national requirements under Art. 26, para. 1 in the Regulation for application of the "Law for the Development of the Academic Staff in Republic of Bulgaria", under the scientific area 5. "Technical sciences", as well as with the rules for holding academic positions at the IBPhBME-BAS, gathering a total number of 782 points, which exceed about 2 times the required minimum of 400 points, according to the summary table below.

Indica-tor	Minimal number of points	Candidate's number of points	Number of points by main indicators in the group
A	50	50	**A.1.** PhD thesis: Diploma no./ issue date: № 27142/23.04.2001, Scientific specialty: 02.21.07 "Automated systems for information processing and management in medicine", Commission No. 5, protocol No. 4/19.02.2001 to the Higher Attestation Commission.
B	100	340	**B.4.** Habilitation work – peer-reviewed scientific publications (at least 10), which are referenced and indexed in recognized international databases with scientific information. A total of 10 publications: 8 in impact factor journals (Web of Science) and 2 publications indexed in Scopus, one of which has an SJR.
G	200	292	**G.7.** Peer-reviewed scientific publication, which is referenced and indexed in recognized international databases with scientific information. A total of 5 publications indexed in Scopus, one of which has an SJR. **G.8.** Peer-reviewed scientific publication in not referenced sources or in peer-reviewed collective volumes. A total of 21 publications
D	50	100	**D.12.** Citations or reviews in scientific publications referenced and indexed in recognized international databases with scientific information or in monographs and collective volumes. 10 citations
A-E	400	782	**Sum of all indicators**

Regarding the points in **Indicator A**, it should be noted that these are fulfilled by the PhD thesis (2001) of Chief Assist. Prof. Dobromir Dobrev. His dissertation, titled 'Methods and electronic devices for neonatal monitoring ' is of significant scientific and practical value, addressing approaches that remain relevant today for telemetric monitoring of cardiac and respiratory activity using a small number of electrodes and enhanced noise immunity. The results presented in the dissertation demonstrate the candidate's excellent foundational preparation in the field of biomedical engineering—both in terms of hardware amplifier design on the patient side and digital signal processing on the recorder side. Such research directions are fully aligned with the scientific interests and activities of the department for which the position has been announced.

In **Indicator B.4** Chief Assist. Prof. Dobromir Dobrev has presented 10 publications indexed in internationally recognized scientific databases, earning him 189 points—approximately 1.9 times above the required minimum of 100 points. Eight of these publications are in prestigious impact factor journals indexed in Web of Science (with a total impact factor of 15.73), ranked in the highest quartiles (Q1 and Q2) across various scientific fields:

- 1 publication (2021) in *IEEE Sensors Journal* (IF=4.325, Q1 quartile).
- 5 publications (2002, 2002, 2004, 2005, 2008) in *Medical and Biological Engineering and Computing* (IF = 1.189 – 1.843, Q2 quartile).
- 1 publication (2012) in *Biomedical Engineering Online* (IF=2.464, Q2 quartile).
- 1 publications (2008) in *Physiological Measurement* (IF=1.951, Q2 quartile).

The candidate has submitted additional 26 publications in **Indicator G**, including 5 indexed publications (G.7) and 21 non-indexed publications (G.8), thus exceeding the minimum requirement of 200 points by an additional 92 points. Two of the publications were published in the journal *International Journal Bioautomation*, one in the journal *Electrotechnica & Electronica (E+E)*, and the remaining papers were included in the proceedings of the *International Scientific Conference Electronics - ET* (2005 to 2022), organized by the Faculty of Electronic Engineering and Technology at the Technical University – Sofia. Five of the conference papers published after 2015 by IEEE are indexed in the Scopus database, one of which has an SJR rank.

In all 36 scientific publications presented under criteria B and G, Assoc. Prof. Dobromir Dobrev has a leading contribution. In 4 of them (11%) he is the sole author, in 29 (81%) he is the first author, and in the remaining 3 (8%) he is the second author. It is noteworthy that in 97% of the publications, the author teams in which the candidate participates are small (up to three researchers), highlighting his personal involvement and contribution to the developed topics. The publications submitted for the academic position of Associate Professor (covering the period 2002–2022) do not duplicate materials from his PhD dissertation (published before 2000). This attests to the candidate's consistent, independent, and purposeful research activity over the past 20 years.

Chief Assist. Prof. Dobromir Dobrev reports 10 citations in Scopus for a single publication submitted in the current competition, which is more than sufficient to earn 100 points, exceeding the minimum requirement of 50 points in **indicator D.12**. It is worth noting that the total number of citations for all his publications included in the competition is significantly higher, reaching 172, confirming the candidate's high scientific visibility.

2. Main Scientific and Applied Scientific Contributions

From the extended habilitation report on the scientific contributions of **Dr. Dobromir Dobrev**, submitted for participation in the competition for the academic position of **Associate Professor**, in publications under indicators **B** and **G**, I can summarize the developments into **three main areas**, each characterized by its most significant **scientific and applied contributions**.

I. Two-Electrode Acquisition and Amplification of Biosignals Without a Reference Electrode

Innovative analog, digital, and mixed-signal solutions have been developed for two-electrode acquisition and amplification of biosignals without a reference electrode. The proposed designs encompass a wide range of approaches — from analog amplifiers with current sources and bootstrap feedback loops [B4.1–B4.5, G8.1–G8.3],

and active balancing of the capacitive bridge between the patient and the amplifier for suppression of common-mode currents [G8.6], to automatic balancing of the electrode–amplifier impedance bridge through analog, digital, and mixed implementations [G7.1–G7.3, G8.7–G8.9, G8.12].

The methods enable hardware suppression of common-mode mains interference by dynamically adjusting the amplitude and phase of the common-mode signal without significantly affecting the spectrum of the useful biosignal. The designs provide high input impedance, high common-mode rejection ratio (CMRR), and stable operation at low supply voltages. They are characterized by high noise immunity, low power consumption, and suitability for integrated implementation.

The developed solutions have the potential to convert reference-electrode-based systems into reference-free ones without loss of signal quality, making them particularly suitable for compact and energy-efficient biomedical devices.

II. Registration and Processing of Biosignals

Innovative hardware and software solutions have been developed for the recording and processing of biosignals from phototransducers, bioimpedance, capacitive, and other sensors, including:

(1) A method for combined electrocardiogram (ECG) and bioimpedance recording, enabling simultaneous monitoring of cardiac and respiratory activity [G8.5];

(2) A compact phototransducer for peripheral pulse monitoring from the forehead region [G8.4, B4.6];

(3) Measurement transducers with active negative feedback for automatic determination of the operating point in sensors with capacitive output impedance. The achieved low-cutoff frequency (0.05 Hz) enables diagnostically accurate ECG recording [B4.10, B4.7];

(4) A method and device for suppression of low-frequency (flicker) noise and offset, based on proprietary techniques for correlated double and multiple sampling of signals from various sensors [B4.9].

The developed solutions are characterized by high sensitivity, precision, low power consumption, and suitability for integration into compact biomedical systems.

III. Filtering of Power-Line Interference from ECG Signals

Innovative analog, digital, and mixed-signal methods and devices have been developed for suppression or extraction of power-line interference from ECG signals, based on comb and synchronous filters. The main achievements include:

(1) Notch comb filters implemented through averaging or first-difference operations, allowing selection of the quality factor and effective suppression of the fundamental and harmonic components of the interference [G8.15, G8.17, G8.18];

(2) Band-pass comb filters with a high quality factor for extracting the interference component [G8.16, G8.20];

(3) Notch comb filters with a linear-phase characteristic, implemented through correlated averaging of first differences, ensuring precise suppression of interference while preserving the waveform of the useful signal [G8.19];

(4) Digital and adaptive synchronous filters based on quadrature demodulation, PLL synchronization, and automatic gain control, enabling dynamic adaptation to variations in interference frequency and amplitude [G7.4–G7.5, B4.8, G8.10–G8.14, G8.21].

The proposed solutions feature simple architecture, high efficiency, and are suitable for implementation in real-time biosignal processing systems with low computational complexity.

3. Significance of the Contributions to Science and Practice

The presented research demonstrates both innovative and applied nature in the field of biomedical engineering, contributing to the improvement of the quality and reliability of registered biosignals. New circuit

designs, methods, and devices have been developed for the recording, amplification, and filtering of weak biosignals, integrating knowledge from electronics, sensor technologies, and digital signal processing.

The main contributions include the development of two-electrode amplifiers without a reference electrode, measurement transducers for simultaneous monitoring of cardiac and respiratory activity, as well as adaptive and comb filters for suppression of power-line interference. Techniques for automatic impedance balancing and correlated multiple sampling have also been introduced, ensuring low noise and high accuracy.

The results have high practical value for the design of medical equipment such as electrocardiographs, defibrillators, ambulatory monitors, and physiological monitoring systems. They contribute to the development of compact, energy-efficient, and reliable medical devices for both clinical and ambulatory diagnostics.

All these developments testify to the profound scientific experience that Chief Assistant Professor Dr. Eng. Dobromir Dobrev has accumulated during his postdoctoral and research work in the field of biomedical engineering. The significance of his contributions is further confirmed by the achievements presented in the habilitation report — a total of 63 scientific publications, over 190 citations, and co-authorship in four patents and one patent application. These accomplishments clearly demonstrate his high scientific competence, active research engagement, and consistent orientation toward innovation with strong practical applicability.

4. Remarks and Recommendations

I have no criticisms of the candidate's materials submitted in the competition for Associate Professor.

In the author's reference related to the competition, no information is provided regarding participation in national or international research projects. Such involvement would serve as additional evidence of the scientific significance and practical implementation of the presented developments, as well as of the candidate's accumulated research experience. I strongly encourage Dr. Dobrev to expand his involvement in research projects, particularly by assuming leadership roles, as his expertise and initiative suggest excellent potential for success in such positions.

Given the innovative nature of the methods presented in several papers from the Electronics (ET) conference, I see strong potential for some of these studies to be further developed, summarized, and published as original articles in impact factor journals. I strongly encourage Chief Assistant Professor Dr. Eng. Dobromir Dobrev to adopt this practice in his future research endeavors, in order to further enhance the quality and significance of his scientific career.

CONCLUSION

The materials submitted for the competitive selection procedure meet the requirements of the Regulation for application of the "Law for the Development of the Academic Staff in Republic of Bulgaria", as well as the rules for holding of academic positions at the Institute of Biophysics and Biomedical Engineering – Bulgarian Academy of Sciences. They allow for an objective and multifaceted assessment of the candidate's qualities. Chief Assistant Professor Dobromir Dobrev is a scientist with proven potential in the field of biomedical engineering.

In essence, the submitted materials show that the requirements according to the national and institutional criteria for holding the academic position of "Associate Professor" are exceeded by all criteria. This gives me reason to confidently propose that Chief Assistant Professor Dobromir Petkov Dobrev is awarded the academic rank of "Associate Professor" in Area of higher education: 5. "Technical Sciences", Professional Field 5.2. "Electrical engineering, electronics and automation", Scientific Speciality „Application of the principles and methods of cybernetics in different fields of science (biomedicine)".

07.11.2025

Sofia

Member of the scientific jury:

/Prof. Vessela Krasteva, PhD/