REVIEW

for procedure for academic position "**Associated Professor**"

Domain of High education: **5. "Technical sciences"**,
Professional field of study: **5.2 " Electrical engineering, electronics and automation "**

Specialty: " **Biomedical engineering and technologies** "

for the needs of the department **"Medical equipment, electronic and information technologies in healthcare"**

The competition is published in "State newspaper" N15/21 February 2025 for the needs of the Faculty of Public Health of the Medical University - Varna

Candidate: **Chief Assisstant Ph.D. Nikolai Tinkov Dukov** from Medical University - Varna

Member of the jury: **prof. DSc, PhD Eng. Todor Atanasov Stoilov**, Institute of information and communication technologies – Bulgarian Academy of Sciences, Sofia, Acad.G.Bontchev str., BL.2

I. Common biographical data of the candidate

Main data about the education and for her scientific degree and academic position of the candidate are summarized in Table1

Table 1.

Name	born	High education	Ph.D.	Positions
Nikolai Tinkov Dukov	22 April 1989 3	2025 – Plovdiv University – Master's in Medical Radiation Physics and Technology 2014 Technical University (TU) – Varna, Master's in "Electronics" 2012 Technical University – Varna, Bachelor in "Electronics"	2019 г. Technical University – Varna, Professional field of study: 5.2 " Electrical engineering, electronics and automation "	2021 Chief Assistant, Medical University of Varna 2020 Assistant, Medical University of Varna 2017 Assistant, Technical University – Varna

The submitted documents from the candidate's CV state that he completed higher education as a bachelor's and master in 2012 and 2014 at TU-Varna as an electrical engineer in the specialty "Electronics". Data is presented for a second master's degree, completed in 2025 at Plovdiv University in the specialty "Medical Radiation Physics and Technology". In 2019, he defended his educational and scientific degree "PhD" at TU-Varna in the professional field 5.2 "Electrical Engineering, Electronics and Automation". In 2017, he was appointed as an "Assistant" at TU-Varna and subsequently at the Medical University of Varna. Since 2021, he has been a "Chief Assistant" at Medical University Varna.

The candidate's current position is "Chief Assistant" in the Department of "Medical Equipment, Electronic and Information Technologies in Healthcare" at Medical University - Varna.

II. General characteristics of the candidate's research and scientific-applied activities

The works presented in the competition for "Associate Professor" are prepared according to the legislative requirements in Bulgaria: The Law for academic promotion, The Rules for the application of this law, and the Internal Regulations of the Medical University - Varna. The presented data for fulfilling the requirements for professional field 5.2 "Electrical Engineering, Electronics and Automation" are verified with the seal of the Medical University - Varna library.

To participate in the competition, the candidate presents a general list of 29 scientific publications. These publications are included and categorized in the document "Academic Reference" to fulfill the minimum requirements for holding the academic position of "Associate Professor". Scientific publications are included in categories B and G of the reference for minimum requirements; citations are for fulfilling the group of indicators D. The candidate also presents data from the group of indicators E, which are not mandatory for the position of "Associate Professor". Projects for which the candidate worked as a member of a teams are presented.

The candidate has also correctly presented lists of publications and activities used for defending the educational and scientific degree "PhD". The attached documents prove that for the current competition for the position "Associate Professor," the candidate correctly presents new, non-overlapping, and previously used results in previous competitions.

Indicators group A: A diploma is presented for the award of the educational and scientific degree "Ph.D." on the topic "Investigating possibilities for creating imitative basic neural structures and their implementations". The candidate satisfies the requirement of this indicator.

Indicators group B: the requirements for this indicator group are to collect 100 points through a monograph, habilitation work or scientific publications (not less than 10) in referenced and indexed in world-recognized databases. The candidate presents 11 scientific publications. All of them have a numerical identifier and/or impact factor (IF according to Web of Science), which proves that they are referenced and indexed in world-recognized databases. As a positive assessment, I

2

note that more than half of them have the highest quantile Q1 and Q2. The reviewer's check of the numerical value of this indicator shows that it exceeds the required level of 100 points.

The reviewer assumes that criterion B is fulfilled in according to the legal requirements.

Indicators group G: it requires the candidate's publications to collect 200 points. The candidate presents 18 scientific publications according to the requirements for category G7 of indexed scientific publications, referenced and indexed in world-recognized databases of scientific information (only Web of Science, Scopus, and others).

The indexed publications were made in the journals Advances in Intelligent Systems and Computing, Journal of Physics: Conference Proceedings, TEM Journal (Q3), Dentistry Journal (Q1), and at international conferences. The papers and the reports were published in a book in a series of the international academic publishing house Springer (Lecture Notes in Networks and Systems) and/or as Proceedings, indexed in Scopus/Web of Science. All submitted reports have a digital identifier DOI, which further proves that they are referenced in world-recognized databases of scientific information.

Publications in non-refereed publications are presented as additional information about the candidate's scientific activity and publication activity.

The reviewer checked the list of submitted titles only until the legislative requirement of 200 points was reached and did not check the full set of the list. The candidate's result exceeds the requirements of the competition.

The reviewer assumes that the publications submitted for participation in the competition meet the requirements of indicator D.

Indicators group D: it requires 100 points obtained by set of citations in scientific publications, referenced and indexed in world-recognized databases and/or editions with scientific peer review. The candidate presents a list in which the number of citations for individual author publications is noted. The candidate presents a list of 5 citations. They were made in publications that are referenced and indexed in world-recognized databases. Thus, the candidate presents 50 points of citations. The candidate also presents data on other citations of publications in his scientific papers. This indirectly shows the potential of the candidate's scientific results in the research carried out.

The reviewer assumes that the submitted citation data in the competition meet the requirements of indicator D.

The candidate also presents other data that may be referred to group E, which are not mandatory for the position of "Associate Professor". Since these data show the candidate in a positive light, I briefly list them: defended bachelor's and master's theses under his supervision, participation in national and international events (conferences, symposia), participation in 13 national and two international projects.

The reviewer's conclusion is that the candidate has sufficient academic and scientific production and meets the legal requirements for participation in this competition. The presented lists allow us to positively assess the performance and, in individual indicators, they exceed the required levels for declared scientific production and scientific and applied activity.

III. Assessment of the pedagogical activities of the candidate

The candidate works as a Chief Assistant at the Medical University - Varna. The main activity in such an Academic University is also teaching. The candidate's pedagogical training and activity are presented in his CV and the officially issued certificate of taught disciplines at the Medical University of Varna and at the previous Technical University of Varna. The submitted documents prove intensive teaching activity. In the position of a Chief Assistant "PhD", he has a significant course of lectures. Such a load is also a requirement for holding the position of "associate professor". In the submitted documents, the reviewer does not find the names of lecture courses taught, but only the number of hours for them.

The reviewer assesses that the candidate has professional training for academic lecturing. The declared workload shows that the candidate has experience in leading an educational process at a University.

IV. Main scientific and scientific-applied contributions

The candidate presents a list of 29 scientific publications for categories B and G of the National Requirements for the Position of Associate Professor. Thematically, they relate to problems and tasks for computer modeling and simulations in the field of breast imaging. Solutions were sought by modeling relevant processes to find accurate assessments of the state of individuals potentially predisposed to a disease state and/or various diseases. The candidate has defined his contributions in 4 categories:

- Development of prototypes (called phantoms) for X-ray imaging. These prototypes are implemented in software. Programmatically, changes and characteristics are set that change the properties of the studied object.

- Modeling of mammary gland lesions. 3D models of tumors are created and their inclusion in already created prototypes/phantoms from the previous field of research. Formal, mathematical dependencies are applied, which allow the creation of nonlinear images of studied objects and processes.

- Development of physical prototypes of the studied objects through 3D printing and creation of imitating tissues. These physical prototypes are subjected to X-ray irradiation to evaluate the suitability of the materials for mammographic applications. This subject area also analyzes the properties of contrast agents as an element of mammographic examinations.

- This subject area is related to research related to the application and improvements in X-ray techniques. A specific problem is obtaining an X-ray image with phase contrast to improve the visualization of details of examined tissues.

The reviewer estimates that in a large part of the research, the candidate develops algorithms for identifying the states of elements of the mammary gland object, modeling and simulation. This identification serves to establish an accurate diagnosis, determine treatment, and monitor the development of processes.

The modeling and simulation processes include activities such as:
- Creation of computational "phantoms" of the mammary gland;
- Mathematical modeling of healthy tissues;
- Reliable delineation and segmentation of lesions;

4

- Comparison of algorithmic modeling with real radiologist results;
- Development of materials for 3D creation of bone and soft tissue prototypes.

These modeling and simulation activities with computer tools lead to scientific results in the candidate's works, which thematically relate to:
- Development of advanced methods for diagnosis and screening of the mammary gland;
- Development of computer and physical models of the mammary gland that allow studying the properties of the relevant tissues.

The submitted copies of scientific publications illustrate that the author achieves scientific and applied scientific results by solving problems that are of the nature of creating computer models for analysis, diagnosis, and prediction of the development of processes in the object of study - the mammary gland.

These results are presented in scientific publications that have found a place in representative scientific journals that have assessments at the highest levels with quantiles Q1 and Q2, in publications of the international academic publishing house Springer, in electronic libraries of international research organizations and publishing houses, and at conferences in our country and abroad.

The reviewer believes that the candidate shows and proves scientific and applied scientific results through the successful development of computer models that he applies in the simulation of processes in the field of medicine.

The reviewer finds scientific contribution in the justification of quantitative assessments of objects and parameters of processes in diseases of the mammary gland.

The reviewer believes that the candidate's publications present successful examples of implemented scientific and applied scientific and applied computer simulations of complex processes in the field of medicine.

V. Significance of the contributions for the science and practice

The candidate's publications show a desire to apply modern computer solutions in the subject areas of healthcare and medicine. For their successful application, computer models of processes have been developed, quantitative evaluation of parameters by simulating a studied object, diagnosis, and prediction of the development of a hospital process. The reviewer is impressed that the candidate conducts his experiments in complex systems such as the human body, applies means of impact such as X-ray irradiation, phase examination, 3D modeling, and prototyping. These activities require significant professional training of the candidate, who must have competence in interdisciplinary fields of medicine, technical sciences, computer, and virtual modeling tools.

Evidence of high professional training is the attached documents for professional certificates and participation in training and qualification courses (in Ljubljana, Italy, Denmark, as well as in our country).

The submitted lists of participation in projects show the candidate's intensive participation in projects for the application of scientific research in practically completed procedures.

These developments and participation in project proposals are also indirect evidence of the usefulness and significance of the candidate's scientific and applied scientific contributions in practice.

VI. Critical remarks and recommendations

The reviewer assesses that the candidate conducts his research in diverse areas and for systems that are complex in nature. This expanded content of the research object and process, as well as the different nature of the technological means used for analysis and diagnostics, requires the maintenance of high qualifications of the scientific researcher. It is evident from the submitted documents that the candidate has successfully maintained and developed his research and technological capabilities. Thus, a positive prerequisite has been created for obtaining significant research results that have been accepted in international academic publications and journals.

I find that the candidate Nikolay Dukov demonstrates extensive research and practical experience in the research area of developing computer models and engineering solutions for the analysis and diagnostics of processes in medicine.

I recommend that this experience of the candidate be widely applied in the training of students and doctoral students in a higher educational institution.

My personal opinion about the submitted documents for the competition is positive. They are carefully arranged and easy to process. I do not find it necessary to make recommendations to the candidate for this competition.

Conclusion

Based on the materials submitted for the competition, their significance, the scientific, applied and applied contributions contained therein, I find that the candidate in this competition Chief Assistant PhD. Nikolai Tinkov Dukov is presented with enough set of research works. In the candidate's works there are original research and practical contributions.

I assess that the legislative requirements of The Law for academic promotion, The Rules for the application of this law, are satisfied. All upper said, and after my acquaintance with the presented documents and their contributions to research and practical results, give me ground to suggest **Chief Assistant PhD Nikolai Tinkov Dukov to take the academic position "Associated Professor"** in Medical University of Varna", for the scientific domain of High education **5. "Technical sciences"**, Professional field of study **5.2 " Electrical engineering, electronics and automation "**, Specialty **" Biomedical engineering and technologies "**, for the needs of the department **"Medical equipment, electronic and information technologies in healthcare"** of Medical University of Varna.

29.05.2025

Reviewer:

Prof. D.Sc., Ph.D. Todor Stoilov