REVIEW

On the competition of taking the academic position "Associate Professor" in professional field 5.2 "Electrical Engineering, Electronics and Automatics", at the Department of " Electronics and Microelectronics" at the "Faculty of Computer Engineering and Automation" of TU-Varna, announced in SG issue 31/19.04.2022 with candidate: Chief Assistant Dr. Eng. Firgan Nihatov Feradov.

<u>Reviewer</u>: Prof. Dr. Eng. Nikolay Dimitrov Madzharov, Dep. "Electronics" at TU-Gabrovo

1. General and biographical data.

The competition for associate professor was announced in SG issue 31/19.04.2022 and on the TU-Varna website, according to the decision of the Academic Council of TU-Varna, on the proposal of the "Faculty of Computing and Automation", Department of "Electronic Engineering and Microelectronics", for the subject " Digital Signal Processing'.

The only candidate in the competition is Chief Assistant Dr. Eng. Firgan Nihatov Feradov. He was born on September 21, 1989 in the city of Varna. He graduated from secondary education at the Professional Technical High School - Varna, majoring in "Electronic Technology" in 2008. He received his higher education at TU-Varna – Bachelor's degree, specialty "Electronics" in the period 2008-2012 and Master's degree with the same specialty in 2012 - 2014, developing a Master's diploma project under the Erasmus program at the University Gene, Belgium.

In the period 2014-2018, he was a doctoral student at TU-Varna and in 2019 successfully defended a dissertation on the doctoral program "Electronicization" on the topic "Research of descriptors of EEG signals for recognition of negative emotional states" and obtained the Doctor's degree.

He started work at TU-Varna in 2018 as an Assistant in the Department of "Electronics and Microelectronics" (EC 10-320 /16.08.2018), and in 2020 he was reappointed to the position of chief assistant in the same department (SA 1C- 591 / 13.02.2020).

2. General description of the presented materials.

The candidate submitted a total of **19** scientific papers for review. All are written in English, **5** (26%) are independent, with one co-author – **2**, with two co-authors – **3**; the remaining **9** have three or more co-authors. The candidate is first in **11** (58%) publications and second in **2**. **18** (95%) of the publications have been published in refereed and indexed world-renowned databases of scientific information. The fact that **5** of the publications are in journals with an impact factor [B.4.2, B.4.3, B.4.4, B.4.6, B.4.9] is impressive. In addition, a list of 8 scientific papers on the dissertation, a list of 4 scientific papers on the competition for "Chief Assistant" and a list of **13** scientific research developments are also presented. **19** scientific papers and **13** research projects are accepted for review, which are taken into account in the final evaluation. 8 research papers on the dissertation and 4 research papers on the competition for "Chief Assistant" are not reviewed.

A reference of **10** citations in SCOPUS, of **4** publications of the author, is attached to the competition materials.

The processing of the data from the presented scientific works shows that Chief Assistant Dr. Eng. Firgan Nihatov Feradov fully meets the minimum national requirements for occupying the academic position "Associate Professor" for the field of "Technical Sciences" in higher education, laid down in Art. 2b of Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), art. 60, paragraph 3 of the rules for implementation of the LDASRB and Art. 1, paragraph 2 from Regulation on the Terms and Conditions for Occupying Academic Positions in TU-Varna.

A summary of this information is as follows:

Group of indicators A - Dissertation for the award of Doctor's degree (at least 50 points) – **50 points**;

Group of indicators B (at least 100 points) – **B.4** scientific publications equivalent to a monographic work - 11 publications, with a different number of authors from 3 - 12. When determining the points, an error was made in publications B.4.3 and B.4.4. The total number of points for this indicator is **166.7** (in the documents it is 165).

Group of indicators Г (at least 200 points) - **Г.7** publications in journals that are referenced and indexed in world-famous databases - 7 publications with different number of authors – 240 points. Of these 7 publications, 5 are independent and 2 have two authors; **Г.8** scientific publications in non-refereed journals with scientific review or in edited collective works - one publication with five authors - 4 points. Total for indicator "Г" - **244 points**.

Group of indicators Д (at least 50 points) – **Д.12** citations – 4 publications are cited a total of 10 times in scientific publications, referenced and indexed in world-renowned databases. Total **100 points**.

Group of indicators Ж (at least 30 points) – **Ж.29**. Timetable of lectures held at TU-Varna for the last three years. According to this indicator, the candidate has provided information on a horary of 254 lecture hours held over the last three years in the disciplines "Microprocessor Systems - Part 1 and 2", "Biomedical Signal Processing" and "Digital Signal Processing", which repeatedly exceed (8.47 times) the minimum requirements under indicator "Ж" of the conditions for awarding academic position "Associate Professor". **Total 254 points**.

The points scored by the candidate are **814.7**, which is significantly (1.89 times) above the total minimum number of **430** points.

3. General characteristics of the applicant's research, scientific and development activities.

The research and scientific-applied activity of the only candidate in the competition is in the field of industrial and medical electronics. Innovative schemes, design methods and algorithms for management of renewable energy sources have been synthesized. New methods for the diagnosis of tumor diseases of the mammary gland have been created and evaluated, with the possibility of use during the medical examination. A large part of the performed analytical and experimental work reflected in the works of the candidate is multiplied in engineering practice and medicine. The following can be noted as more significant highlights:

- Electronic circuit allowing to increase the energy efficiency of solar voltage converters;
- Automated algorithm for segmentation and creation of three-dimensional models of mammary tumor formations based on images from three-dimensional computed mammography (DBT) and computed tomography;
- Algorithms used for automated design and selection of components and topologies of power electronic converters;

- Methods for automated classification of emotional states and cognitive activity from electroencephalographic (EEG) recordings;
- Databases containing physiological signals for the purposes of research on emotional states in humans.

For this wide range of scientific research work of Chief Assistant Dr. Eng. Firgan Nihatov Feradov made a significant contribution and his participation in 6 projects financed by the state budget, 3 projects financed by the National Scientific Research Fund and two projects financed by international programs of the EU, one of them by the "Horizon" program 2020".

From 2019 until now, the candidate has prepared a total of reviews of 11 scientific papers in the Yearbook of TU-Varna (4 issues) and at the conference on "Biomedical Innovations and Applications" (7 issues). He actively participates in the organization and conduct of the scientific forums - he is a member of the organizing committee of the conference on "Biomedical Innovations and Applications" BAI 2020 and 2021 and was the chairman of 2 sessions of the scientific conference on "Biomedical Innovations and Applications" in 2021.

4. Evaluation of the applicant's teaching capabilities and activities.

From the documents issued by TU-Varna, it can be seen that Chief Assistant Dr. Eng. Firgan Nihatov Feradov is a doctoral student in the period 2014-2018, assistant 2018-2020 and chief assistant from 2020 until now. The submitted reference shows that in the last three years the applicant has a full workload in the Department of "Electronics and Microelectronics" - 504.2 hours for the academic year 2018-2019, 640.2 hours for the academic year 2019-2020, 509.6 hours for the academic year year 2020-2021 and 644.9 hours for the academic year 2021-2022. He has led lectures and laboratory exercises in 7 disciplines from the curricula for Bachelor's and Master's degrees, including in English, for majors: "Electronics" (E), "Biomedical Electronics" (BME), "Software and Internet Technologies" (SIT), "Computer Systems and Technologies" (CST) and "Internet and Communication Technologies" (ICT). During this period, he was supervisor of 8 diploma theses and reviewer of 12 - in total for Bachelor's and Master's degrees.

Chief Assistant Dr. Eng. Firgan Nihatov Feradov participated in the development of three study programs - "Microprocessor Systems - Part 1", "Testing and Verification of Electronic Devices" and "Electronic and Microprocessor Technology". Supports the educational process in the "Electronics and Microelectronics" department by: taking part in the state examination commissions for conducting diploma defenses for the Master's and Bachelor's degrees; responsible for the 1st and 2nd year students in "E" and "BME" majors; is responsible for organizing the educational activity, the administration of the distance learning system and the organization of student mobility under the ERASMUS program in the EM department, participation in events related to candidate student campaigns.

The candidate has good language skills. He speaks English at the C2 level, which allows him to maintain useful contacts and exchange information with colleagues from abroad working in his scientific field. In this connection, 5 mobilities with a total duration of 172 days were carried out in universities in Great Britain, Belgium and Norway.

To the pedagogical activity of Chief Assistant Dr. Eng. Firgan Nihatov Feradov, should also be credited for his personal contribution to the modernization of the laboratory base of the "Electronics and Microelectronics" department.

A certificate signed by the head of the department Assoc. Prof. Bekov has been presented, which proves the work done by the candidate on the renovation of the material and technical base of the laboratories "Microprocessor Systems" (114E), "Power Electronics" (603aE), "Industrial

Electronics" (609E). A good impression is made by the fact that much of the new equipment was delivered under the project with the participation of the applicant.

5.   Key scientific and scientific-applied contributions.

5.1. Publications equivalent to a monographic work - indicator B4 (B4.1 - B4.11).

The publications of this index are thematically united in two scientific areas related to new hardware and software solutions in the field of power and medical electronics. The candidate has presented in detail and systematically the contributions in these works, the main part of which relates to the formulation, justification and application of a new model, theory, hypothesis, methodology and construction, regarding innovative systems and software solutions improving the energy and operational indicators of industrial and medical arrangements.

I believe that the **scientific contributions** of this work can be summarized as follows: a new automated algorithm for segmentation and creation of three-dimensional models of tumor formations was developed [B.4.3, B.4.4]; a scheme and an algorithm of operation of a DC/AC converter with improved efficiency through the use of a capacitor in the direct current connection and modulation of the output voltage were synthesized [B4.1, B4.2].

The scientific-applied contributions have a strong applied component and refer to the application of the developed models in engineering practice with the aim of creating a new database containing a wide range of three-dimensional computer models of real tumor formations and mathematically generated tumor formations used for imaging purposes of cancerous formations [B.4.4]; a new methodology was developed and verified, including modeling and printing of the various elements of the researched object, used in the creation of anthropomorphic phantoms and detection of tumor formations [B.4.5, B.4.6]; new and improved descriptors for the automated classification of cognitive load from photoplethysmographic (FPG) signals and galvanic skin resistance (GSR) recordings are proposed and evaluated [B.4.10, B.4.11]; a new methodology was developed for the processing of electroencephalographic (EEG) signals and for the calculation of frequency and time-frequency descriptors applicable to automated classification of cognitive states [B.4.9]; algorithms for the selection of topologies [B.4.8] and automated design of transformers [B.4.7] in the development of electronic converters have been synthesized.

5.2.Scientific publications by indicator Д [Д.7.1 – Д7.7, Д.8.1].

I accept the contributions formulated by the candidate regarding the publications with which he participated in the competition for Associate Professor - a total of 8 scientific articles and reports.

Scientific-applied contributions consist in applying the developed models and analytical apparatus and obtaining confirmatory facts in the development and research of new and existing algorithms and methodologies for data collection and their analysis for various physiological signals.They can be summarized as follows: a new methodology was developed for obtaining descriptors of EEG signals and their processing, applicable in automated assessment of various emotional states [Д.7.1, Д.7.2]; new spectral descriptors have been developed for processing EEG signals based on image processing methods used in automated classification of cognitive brain activity [Д.7.4, Д.7.5]; a methodology was developed for obtaining spectral descriptors of EEG signals for the purposes of the automated classification of cognitive activity of the brain when perceiving, transmitting, analyzing and memorizing various information [Д.7.6]; an algorithm based on wavelet transformation was developed, applicable in the parameterization of time-

dependent peaks of brain activity and the modeling of brain activity in specific multimedia signals [Д.7.7].

Applied Contributions. It should be noted that almost all developments presented under indicator Д have an applied nature and are related to a specific application in medical electronics. Their general application can be summarized as follows: new requirements for EEG signal recording protocols applicable to the study of certain brain functions have been formulated [Д.7.3]; a SLADE database of various biosignals was created, through which emotional states are recognized and stress levels are assessed [Д.8.1].

In conclusion, the contributions in the presented publications can be referred to the category - creation of new methods and models, development of methodologies for analysis and design of industrial and medical systems and experimental obtaining of new data. Judging by the composition of the author's collective with which Chief Assistant Dr. Eng. Firgan Nihatov Feradov, analyzing the number and arrangement of the co-authors of the scientific works, I believe that the formulated contributions are the personal work of the candidate and faithfully reflect his primary participation in the achieved scientific and applied scientific results.

6.   Significance of contributions for science and practice.

The scientific and scientific applied research of Chief Assistant Dr. Eng. Firgan Nihatov Feradov have contributions to theory, practice and training, as they are dedicated to current problems of the development of modern industrial and medical electronics - synthesis, design, analysis and research of methods for improving hardware and software device parameters in the mentioned scientific fields. The importance of the created analytical apparatus is significant, because mainly completed software developments are offered, some of which are implemented in practice, and others in the implementation of 13 scientific research projects.

The author's contributions have become known to the scientific community at home and abroad through his publication activity (a total of 32 scientific papers, of which 19 for the competition for the academic position " Associate Professor") in authoritative journals and forums - **the journals**: Renewable Energy and Power Quality Journal; Journal of Electrical Engineering; European Journal of Medical Physics; Computers; **- the conferences**: 28th International Scientific Conference Electronics, ET 2019; Madicon 2019, Portugal; , SIELA 2020; ICAI 2020; BIA 2020; BIA 2021; MIPRO 2021, Croatia; ET 2021, Computer Science and Technologies, 2016.

This is evidenced by the established 58 citations from the reference in Scopus, as a result of which the candidate has a Hirsch index of 4 (as of 1.08.2022, after submission of the documents). For the competition, 10 citations of 4 publications in scientific publications, referenced and indexed in world-famous databases - Brain Sciences, Sensors, IEEE Access 8, Frontiers in Computational Neuroscience, Applied Soft Computing, Journal of Medical Imaging, Physics in Medicine and Biology, Journal of the International Measurement Confederation, International Journal of Imaging Systems and Technology, Biocybernetics and Biomedical Engineering.

The presented quantitative indicators correspond to the criteria for occupying the academic position "Associate Professor", which was discussed in detail in item 3 of this review.

7.   Critical remarks and recommendations.

I have no serious objections to the presented materials. I note only some recommendations:
- in his future work, the candidate should devote more time to implementing his research results in real business and support them with relevant documents;

- the topic in medical electronics on which he is working is new and very current, and it is expedient to summarize the results achieved so far in educational literature;
- I recommend to further develop the experiments on publications B.4.1 and B.4.2 and look for opportunities for implementation, which is in connection with the growing requirements for the production of electrical energy from renewable energy sources.

8. Personal impressions and opinion of the reviewer.

With Chief Assistant Dr. Eng. Firgan Nihatov Feradov, I have no joint publications, I have not participated in joint projects and I am not a person related to him in the sense of paragraph 1, item 5 of the Additional Regulations of the Law for Academic Staff Development in the Republic of Bulgaria. My assessment of him is entirely based on the materials provided for the competition, from the professional information available on the Internet and from some scientific conferences in which he participated. I emphasize again that 5 of his publications are in journals with an impact factor. Based on this information, I believe that he is an experienced and well-prepared teacher in Digital Signal Processing and in particular in the application of innovative software solutions in medical practice.

CONCLUSION

My general assessment is that the applicant's presentation in the competition for occupying the academic position " Associate Professor " corresponds with the requirements of the Law for Academic Staff Development in the Republic of Bulgaria, Implementation Regulations of the Law for Academic Staff Development and Rules of the Conditions and Procedure for Occupying an Academic Position in the Technical University of Varna.

Based on the acquaintance with the presented scientific works for participation in the competition, their significance, the scientific, scientific-applied and applied contributions contained in them, I find it reasonable to propose Chief Assistant Dr. Eng. Firgan Nihatov Feradov to take the academic position "ASSOCIATE PROFESSOR" in the professional field 5.2 "Electrical Engineering, Electronics and Automation" for the discipline "Digital Signal Processing" at the Department of "Electronics and Microelectronics" of TU-Varna.

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/Prof. Dr. Eng. Nikolay Dimitrov Madzharov/