REVIEW
to occupy the academic position:

"Professor"	
"Associate Professor"	**X**
	one of the academic positions indicated shall be marked with the sign "X"

Candidates to occupy the position:

1	Assistant Prof.	Doctor	Svetla	Dimitrova	Lekova	UCTM
№	academic position	scientific degree	name	middle name	last name	workplace

Scientific area:

5.	Technical Sciences
code	name

Professional area:

5.2	Electrical engineering, electronics, automation
code	name

Scientific specialty:

Automation of engineering work and systems for automated design

The competition has been announced:

67	04.08.2023	Dept. of Industrial Automation	Chemical and System Engineering
in SG issue	date	for the needs of the Department	Faculty

The review was written by:

Professor	Doctor	Idilia	Alexandrova	Batchkova	UCTM
academic position	scientific degree	name	middle name	last name	workplace

1. Review for the candidate:

Assistant Prof.	Doctor	Svetla	Dimitrova	Lekova
academic position	scientific degree	name	middle name	last name

1.1. Completion of the provided documents:

A) The competition documents are in full compliance with the Regulations	3 points	**X**
B) The documents are complete but do not fully comply with the	2 points	

requirements of the Regulations		
C) The documents are not completed in accordance with the requirements of the Regulations	0 points	
		one of the answers given is marked with the sign "X"

Missing documents and violated requirements must be described if response C is marked.

1.2. Meeting the minimum requirements under the Regulations:

A) The candidate meets the minimum requirements	20 points	**X**
B) The candidate doesn't meet the minimum requirements	0 points	
		one of the answers given is marked with the sign "X"

It must be filled in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed.
The candidate participates in the competition with a monographic paper, which is based on 8 publications in refereed publications, with which the candidate has not participated in previous procedures. 5 of these publications are referenced and indexed in SCOPUS (B1, B2, B3, B4 and B5) and three are in journals and proceedings from the NACID reference list (C7, C12 and C13). These publications are not included in the determination of the points of indicator G, which are estimated at 284.3 points and exceed the minimum requirements for this group of indicators, which can be seen in the presented comparison table below. 5 of the publications presented for the competition were cited a total of 18 times, 5 of the citations of the publication are related to the candidate's dissertation work. The total number of citation points amounts to 190, of which 150 in the points of 15 citations in publications referenced and indexed in SCOPUS.

Group of indicators	Content	Assoc. Professor	Assist. Prof. Lekova
А	Indicator 1	50	50
Б	Indicator 2	-	-
В	Indicator 3 or 4	100	100
Г	Sum of indicators from 5 to 11	200	284,3
Д	Sum of indicators from 12 to 15	50	190
Е	Sum of indicators from 16 to the end	-	80

1.3. Relevance of scientific and / or applied research:

A) The research is relevant. Part of the research is pioneering (no results are known on the topic by other authors)	7 points	
B) Research is relevant. Results from other authors are known for each of the topics and / or applications studied.	5 points	**X**
C) Most of the research is relevant, but also some results are presented that have no scientific and / or applied value	3 points	
D) The smaller part of the research is relevant	2 points	
E) Research is not relevant	0 points	

		one of the answers given is marked with the sign "X"

The evaluation of the relevance of the research must be substantiated.
The thematic areas covered by the research activity of the Assistant Professor Dr. Svetla Lekova are related to data processing and analysis and are extremely relevant for the following reasons:
1) "Data analytics" and "data driven business" are indicated as one of the ten main trends in the field of digital transformation for 2024;
2) With the development of the Internet, sensing and measurement techniques, embedded systems and large volume storage capabilities, the need to use effective data analysis techniques to extract useful information and new knowledge is increasing;
3) In the conditions of "Industry 4.0" there is a rapid development and application of digital technologies and artificial intelligence in the industry. It has been proven that some of the most successful and effective methods of artificial intelligence are in combination with statistical ones.
4) Big data processing is becoming increasingly important and is one of the pillars of Industry 4.0.

1.4. Knowledge of the problems subject of research:

A) The candidate knows in detail the achievements of other authors on the researched topics and/or applications	6 points	**X**
B) The candidate is partially familiar with the achieved results on the researched topics and / or applications	4 points	
C) The candidate has no prior knowledge of the status of the researched problems	0 points	
		one of the answers given is marked with the sign "X"

The evaluation must be substantiated if answer C is marked.

1.5. Type of research:

A) Theoretical	4 points	
B) Applied	4 points	
C) Theoretical with application elements	4 points	**X**
D) It does not correspond to the level specified in the Act for the Development of the Academic Staff in the Republic of Bulgaria and the Regulations	0 points	
		one of the answers given is marked with the sign "X"

The level of research must be substantiated if answer D is marked.

1.6. Objectives of the research:

A) Realistic and of scientific and / or applied interest	8 points	**X**
B) Realistic, but not of scientific and / or applied interest	4 points	
C) Unattainable (unrealistic)	0 points	
		one of the answers given is marked with the sign "X"

Objectives must be specified. The type of the set objectives must be justified.
The main objectives of the research activity provided by the candidate are related to: • Development and application of modern methods for analyzing the origin and quality of honey and other products;   • Mathematical modeling and optimization of technological processes;   • Modern approaches to environmental monitoring;   • Improvement of energy efficiency and implementation of systems for renewable energy sources;   • Industrial automation;   • Studies of other current engineering problems.

1.7. Methods of research:

A) Adequate to research and set scientific objectives and /or applications	8 points	**X**
B) Partially appropriate, enabling part of the scientific objectives and / or applications to be achieved	4 points	
C) Inappropriate methods	0 points	
		one of the answers given is marked with the sign "X"

Methods must be specified. The type of methods used is justified.
The methods used can be summarized as follows: • Method of principal components;   • Linear and quadratic discriminant analysis (LDA, QDA);   • Naive Bayes classification (NBC);   • k mean clustering (KMC);   • Artificial neural networks;   • Method for calculating linear and rank correlation;   • Analysis of significance of factors;   • Methods for pre-processing data from spectrographic analysis;   • Method of moving averaging;   • Design of experiment;   • Linear regression analysis;   • Non-linear optimization methods;   • Gradient method with a chaotic forcing component;

• Random search method with a chaotic forcing component; • A simplex method with a chaotic forcing component		

1.8. Candidate research contributions:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	**X**
C) They are of scientific and / or applied interest	12 points	
D) Lack of significant contributions	8 points	
E) Lack of contributions	0 points	
		one of the answers given is marked with the sign "X"

Contributions must be specified. The type of results achieved must be justified.

Contributions are categorized by thematic areas:
A. Advanced methods for analysis of the origin and quality of honey and other products (affects the presented monograph with included 8 publications, as well as 1 publication from group G - C4, a total of 9 publications).
Scientific and applied contributions:
1. An overview of the methods for establishing the authenticity of honey has been prepared.
 	
2. Approaches have been developed for the recognition of honey by botanical origin, which are based on the application of the principal component method (PCA) in combination with the following classification and clustering methods [B1, B2, B3, B4, C12, C13]:
    • linear discriminant analysis (LDA);
    • quadratic discriminant analysis (QDA);
    • Naive Bayes classification (NBC);
    • k means clustering (KMC);
    • neural classifier [C12].
 	
3. A comparative analysis of the four classifiers: linear and quadratic discriminant analysis (LDA, QDA), Naive Bayes classification (NBC) and k mean clustering (KMC) was performed for the honey Vis spectroscopy data [C13].
 	
4. The influence of spectral wavelengths in Vis-NIR spectroscopy was investigated to facilitate the design of a simple and low-cost copper detection sensor in practice [B1].
 	
5. Adaptation of the moving averaging method for smoothing UV-Vis spectroscopy data [B4].
 	
6. Two main classes of models of the electrical conductivity of honey have been developed: (1) models using classical linear parameter estimation and (2) models, nonlinear in parameters, based on nonlinear optimization techniques [C7].
 	
7. A comparative analysis of the methods for UV, VIS and FTIR spectroscopy, laser refractometry, electrical conductivity and Differential Scanning Calorimetry (DSC) was performed in relation to the study of bee honey with a view to its recognition according to its botanical origin [B2].
 	
8. A method was developed for calculating linear and rank correlation and analyzing the significance of the "laboratory" factor in measuring the concentrations of products from a flotation process [B5, C4].
 	
Applied Contributions:
1. The developed approaches have been applied to recognize bee honey by botanical origin in a MATLAB environment based on the following data:
    • data from Vis spectroscopy of honey by all 4 methods [C13];
    • data from Vis-NIR spectroscopy of honey, using (1) supervised Bayesian classifier and (2) k-

means clustering [B1];
- UV-Vis spectroscopy data of honey using (1) Bayesian supervised classifier and (2) k-means clustering [B4];
- a combination of Mid-FTIR spectra, colorimetry and the use of linear discriminant analysis (LDA) [B2, B3].

B. Mathematical modeling and optimization of technological processes (19 items):

<u>Scientific contributions:</u>

1. An approach for finding a global extremum of a multi-extremal objective function based on the combination of classical local extremum search methods and a chaotic forcing component is proposed [C10, C11, C22, C25, C26, C27].

2. A modification of the gradient method with chaotic forcing in the presence of an equality type constraint [C27] was proposed, consisting in the addition of an additional term in the potential function.

<u>Scientific and applied contributions:</u>

1. The approach for finding a global extremum of a multi-extremal objective function is applied to the following classical methods for finding a local extremum:
- Gradient method [C10, C11, C25, C27];
- Random search method [C26];
- Simplex method [C22].

2. Static models were created and the following technological processes were optimized [C17, C18, C21, C31, C31]:
- preparation of wood polymer nanocomposite materials [C17, C18]
- production of electrically conductive polyacrylonitrile (PAN) fibers [C31]
- production of textile materials with high microwave absorption properties by the pigment printing method [C32]
- the influence of alloying components on the hardness of complex alloyed powder metallurgical steels [C21]

3. Dynamic models were created and the following technological processes were optimized [C1, C6, C24, C29, C30]:
- production of wine vinegar [C1, C6];
- the properties of waste water treatment materials [C24, C29, C30]

4. A comparative analysis of the methods for obtaining models in the form of a transfer function based on data from the transient characteristic with the use of orthogonal decompositions with Kautz functions and Lager functions was performed. [C15, C16]

5. A comparative analysis of four methods for recurrent estimation of linear stationary models was performed based on model tests under different initial conditions and noise level [C33].

<u>Applied Contributions:</u>

1. A MATLAB simulation environment was developed to study and demonstrate the proposed modified global extremum search methods [C10, C11, C22, C25, C26, C27]

C. Environmental monitoring, energy efficiency and renewable energy sources (5 items):

<u>Scientific and applied contributions:</u>

1. An overview of the methods and sensors for measuring fine dust particles in the atmospheric air, temperature and illumination at the workplace was made [C2, C3].

2. The operation of LLC resonant DC-DC converters below and above the resonance frequency was investigated. [C5]

3. A methodology for designing the considered converter is proposed, with the calculated error being less than 5% [C5]

4. A transistor voltage inverter circuit is proposed for obtaining alternating current power from a photovoltaic voltage source, from a storage battery, or from both [C20]

<u>Applied Contributions:</u>

1. A system for measuring and analyzing the information from a sensor for fine dust particles, temperature and illumination was designed and implemented [C2, C3].

2. The economic mode of two transformers operating in parallel in a 2x630 kVA transformer station and in a 2x25 MVA city substation was analyzed [C14].

D. Automation of production (3 pcs.)

Scientific and applied contributions:

1. Created simulation models in MATLAB environment for training purposes [C8, C19, C28]:
   - Engineering setting of Smith predictor for high-order dynamic objects [C8];
   - Investigation of an asynchronous capacitor motor with an eddy current brake [C19]
   - Virtual models of a small power single-phase transformer [C28]

Applied Contributions:

1. Development of examples and tasks in working with simulation models and their testing [C8, C19, C28]

D. Others (3 pcs.)

Scientific and applied contributions:

1. A methodology was proposed for the joint use of elements of fractal geometry and statistics for processing mammograms and classifying some lesions into two classes - benign and malignant [C23].

2. Summary of some tribological applications of graphene [C9].

3. An approach to training medical students using augmented reality is proposed [B6].

1.9. Participation of the candidate in the achievement of the presented results:

A) The candidate has at least an equal participation in the submitted papers	8 points	
B) The candidate has at least an equal participation in most of the submitted papers	7 points	**X**
C) The candidate has a secondary participation in most of the submitted papers	4 points	
D) The candidate participation is unnoticeable	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items C or D is marked.

1.10. Pedagogical activity:

A) The candidate has effective and sufficient pedagogical activity at the university. The textbooks issued are modern and useful (they meet the requirements of the Regulations). The work with undergraduate and doctoral students is at a high professional level.	8 points	**X**
B) The candidate has sufficient pedagogical activity at the university. The textbooks issued satisfy the requirements of the Regulations.	6 points	
C) The pedagogical activity and / or textbooks issued are insufficient (do not meet the requirements of the Regulations)	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items B or C is marked.

1.11. Critical notes:

A) Lack of critical notes	8 points	
B) Critical notes of a technical nature	7 points	**X**
C) Critical notes that would partially improve the results achieved in a small part of the research	5 points	
D) Critical notes that would partially improve the results achieved in most of the research	3 points	
E) Significant critical notes	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the answers C, D or E is marked.

1.12. Conclusion

A) The evaluation of the candidate's activity is **POSITIVE**	This evaluation is assigned to a total number of at least 65 points	**X**
B) The evaluation of the candidate's activity is **NEGATIVE**	This evaluation is assigned to a total number below 65 points	
		one of the answers given is marked with the sign "X"

To be filled in if requested by the reviewer
Based on the assessment made of the candidate's scientific research and pedagogical activity, the relevance and significance of the contributions in the presented works, leading to a total assessment of **92 points**, I consider it reasonable to propose to the Honorable Jury the announced competition (SG No. 67 of 08/04/2023) to submit a report to the Faculty Council of the Faculty of Chemical and Systems Engineering, **Assistant professor Dr. Svetla Dimitrova Lekova** to take the academic position of **ASSOCIATE PROFESSOR** at UCTM-Sofia in professional direction 5.2. "Electrical engineering, electronics and automation", in the scientific specialty "Automation of engineering work and systems for automated design".

22.11.2023	The review was written by:	
date		signature