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	CHIEF ASSIST.	Dr.	DIMITAR	BORISOV	BORISOV	UCTM
№	academic position	scientific degree	name	middle name	last name	workplace

Scientific area:

5	TECHNICAL SCIENCES
code	name

Professional area:

5.13	GENERAL ENGINEERING
code	name

Scientific specialty:

Technologies and systems for environmental protection

The competition has been announced:

104	5.12.2025	ENVIRONMENTAL ENGINEERING	CHEMICAL AND SYSTEMS ENGINEERING
in SG issue	date	for the needs of the Department	Faculty

The review was written by:

ASSOCIATE PROFESSOR	Dr.	SILVIA	IGOROVA	LAVROVA-POPOVA	UCTM
academic position	scientific degree	name	middle name	last name	workplace

1. Review for the candidate:

CHIEF ASSIST.	Dr.	DIMITAR	BORISOV	BORISOV
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 requirements of the Regulations	2 points	
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 publication activity of the candidate meets the requirements of the Regulations for occupying the academic position of "Associate Professor", and monographs (Indicator 3 – 100 points) and scientific papers published in refereed and indexed journals (Indicator 7 – 3 publications, 120 points), as well as those with scientific peer review (Indicator 8 – 16 publications, 233.3 points) are presented. There is a scientific response to the results achieved, expressed through citations in the scientific literature, including in international publications related to the issues under consideration. The number of citations found is not large (4 in scientific journals, refereed and indexed in world-renowned databases, and 5 in non-refereed journals with scientific peer-review), but it is sufficient to meet the minimum scientometric requirements. In this sense, it can be assumed that the candidate satisfies the minimum requirements for occupying the academic position of "associate professor".

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 research of Chief Assist. Dr. Eng. Dimitar Borisov are focused on current problems related to the optimization of technological processes, multi-criteria analysis and rational decision-making, as well as increasing resource efficiency and limiting the impact on the environment. The topics discussed are widely represented in the modern scientific literature and are the subject of research by a number of authors, which confirms their significance. The results obtained fit into established scientific directions and contribute to their development and application.

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 objectives of the research are clearly formulated and can be considered in two main directions – theoretical and applied. The theoretical objectives are aimed at developing and improving optimization and decision-making methods, including the creation of new and modified algorithms with improved efficiency. The applied objectives include the development of mathematical models for analysis and optimization of technological processes, including tasks for minimization, recovery and disposal of industrial waste, as well as for increasing resource and energy efficiency. The goals set are realistic and consistent with the methodological tools used, including mathematical modeling, numerical methods and optimization algorithms. They are scientifically applied and are aimed at solving practically significant tasks, including in the field of environmental protection.

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.
In the candidate's research, modern methods of mathematical modeling (material and energy balances, analytical and regression models), numerical optimization methods (dichotomy methods, Fibonacci and the golden ratio, Kiefer–Johnson method, gradient and gradient methods), heuristic algorithms and approaches for multi-criteria analysis and decision-making (random search methods and random directions, generalized utility functions, Pareto optimality and compromise solutions). Both classical methods of search for extremum and developed and modified algorithms with improved convergence and efficiency are applied, with particular emphasis placed on the development of accelerated optimization algorithms. The methods used are adequate to the scientific goals set related to the optimization of technological processes and systems, as well as to the evaluation and selection of rational solutions in the presence of multiple criteria. The application of mathematical modeling, numerical experiments and approximation approaches allows the analysis of complex engineering objects and processes, including those related to environmental protection. The developed models and algorithms are verified through numerical experiments and comparative analysis with classical methods, which contributes to the reliability and interpretability of the results obtained. In this sense, the chosen methodological approach provides an opportunity to achieve the set goals and obtain substantiated scientific results.

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.

The main scientific and applied scientific contributions described in publications submitted for this competition are the following:

1. New combined methods with accelerated convergence for optimization based on the dichotomy, the golden section and the Kiefer-Jonson method are proposed and 6 combined new methods are proposed, which are tested with 6 test functions of varying complexity, which show that the new modified methods are much more effective than the classical ones and give a solution 2 to 4 times faster, depending on the size of the admissible space of the control parameters. One-dimensional methods are part of multidimensional methods and the higher the dimensionality of the optimization problem, the greater the efficiency of the new proposed methods.

2. A new heuristic algorithm with accelerated convergence for one-dimensional optimization in boundless space is proposed and studied. The algorithm includes the first four Fibonacci numbers and a series of third-order numbers. A comparative study with other efficient algorithms is presented. The results show that the newly proposed method has a better convergence speed.

3. A new stochastic random search method and an algorithm for multidimensional optimization with accelerated convergence are proposed, three new modifications of it are proposed. From the study of the proposed new algorithms with 4 objective functions, it is shown that the new methods for multidimensional optimization have much faster convergence than the classical methods for random search. The study of the new methods in comparison with the classical ones shows the advantage of the new proposed methods. The methods can be easily modified for problems with functional constraints and for equality type. The newly proposed method is universal and with a small modification can be applied to ridge type objective functions, as well as for searching for a global extremum of many extremal problems using a search from multiple random starting points.

4. A new accelerated algorithm for multidimensional optimization for complex ridge objective functions is proposed. The main goal is to combine the advantages of the method for random search from multiple random directions with a constant step for searching for the extremum of unimodal functions and the advantages of the Gelfand and Tsetlin method. Based on a comparative analysis, it is proven that the proposed algorithm gives 2 to 4 times faster convergence compared to the classical Gelfand and Tsetlin algorithm.

5. A new accelerated algorithm for global optimization based on Price's method is proposed. In the new method, groups of pairs of points are created, on the basis of which new points are calculated that replace the worst ones. In the presented new method, as well as in Price's method, the values of the worst result are constantly improved and thus the points begin to be condensed around the global maximum. A comparative analysis was made with 12 multi-extremal functions. In the study of the new 4 methods with accelerated convergence when searching for a global extremum, MGO3 and MGO4 can be indicated as the most effective, which are more effective than MGO1 and MGO2 in all multi-extremal tests. The speed of convergence to the solution of the new proposed methods and algorithms significantly exceeds the speed of convergence of the best known Price's method to date.

6. New fractional-rational generalized strategies for finding optimal decisions with and without the use of weighting coefficients are proposed. The proposed strategies are studied with real technological examples. Results are presented and leading solutions are recommended. In multi-

criteria optimization, the choice of the compromise solution is most strongly influenced by the type of generalized strategy, the type of compromise solution satisfying the experts, and the determination of the most desired (recommended) value. The range of variation is the largest and, accordingly, the greatest sensitivity is with the generalized fractional-rational mean harmonic strategy for making a rational decision.

7. A method to improve the accuracy of a deep learning model for fire detection by pre-processing images collected by cameras is proposed. Experimental results show that the accuracy of the proposed model in this paper reaches over 92%, which is higher than other deep learning models.

8. An object detection technique specifically designed for autonomous vehicles based on YOLOv5 is studied. The experimental results demonstrating the performance of YOLOv5 on reference object detection datasets, including its accuracy, speed, and real-time applicability, demonstrate that YOLOv5 achieves state-of-the-art object detection results.

9. A method for improving the accuracy of a deep learning model for detecting brain anomalies based on computed tomography images has been studied. The experimental results show that the presented method achieves high accuracy.

The candidate's contributions can be summarized as aimed at developing and improving methods for optimal process management and decision-making, with an emphasis on improving speed and reliability in finding the optimum.
Research builds on existing approaches by combining different techniques and leads to better results in terms of computational efficiency and practical applicability. The results obtained are used in solving problems related to technological processes and environmental protection.

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	**X**
B) The candidate has at least an equal participation in most of the submitted papers	7 points	
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	
B) The candidate has sufficient pedagogical activity at the university. The textbooks issued satisfy the requirements of the Regulations.	6 points	**X**

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.
The candidate Chief Assist. Dr. Eng. Dimitar Borisov carries out active pedagogical activities by conducting lectures and exercises in the specialized disciplines "Environmental Monitoring" part II, "Simulation of the Spread of Pollutants", "Environmental Audit and Optimal Solutions in the Environmental Protection", and "Information Technologies in Environmental Protection", studied by the students in the special. "Environmental engineering" - "Bachelor" and "Ecology and Environmental Protection" - "Master", administered by the Environmental engineering Department, as well as in some fundamental disciplines, such as "Informatics" I and II parts, "Electrical Engineering and Electronics", studied by other specialties at UCTM, with an average annual teaching load exceeding 350 hours. The classes in the listed specialized disciplines are in full compliance with the profile of the competition. The training materials developed by him, including the textbook for seminar exercises on "Environmental Audit, Optimal Solutions and Data Processing in Environmental Protection" published in 2025, support the learning process and meet the requirements of the University and the Publishing Regulations of UCTM. To date, the Candidate's activities do not include managing graduate and PhD students, which presents an opportunity to further develop his pedagogical experience.

1.11. Critical notes:

A) Lack of critical notes	8 points	
B) Critical notes of a technical nature	7 points	
C) Critical notes that would partially improve the results achieved in a small part of the research	5 points	**X**
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.
The monographic work of Chief Assist. Dr. Eng. Dimitar Borisov presents an in-depth analysis and development of modern methods for optimization and rational decision-making. The algorithms considered are universal in nature and can be applied in various fields. A significant contribution of the study is the systematization and comparative analysis of various optimization approaches, as well as the proposed algorithmic solutions to increase the efficiency in the search for the optimum. Approaches to improving convergence and reducing computational complexity are also presented, which is important for their practical application. At the same time, the presentation does not clearly highlight a specific subject area, as well as there are no examples or cases related to ecological systems. The research is mainly focused on theoretical mathematical models and standard test functions, which leaves room for the developed approaches

to be further developed in a more applied direction. In future research, it would be useful to apply the proposed methods to real-world tasks in environmental engineering and to validate them with empirical data, thereby increasing their practical relevance.

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** **89 points**
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
The established compliance with the requirements of the Regulations for Acquiring Scientific Degrees and Occupying Academic Positions at UCTM, the Law on the development of the academic staff in the republic of Bulgaria, as well as with the Regulations for the implementation of the law on the development of the academic staff in the republic of Bulgaria, based on the submitted documents, scientific materials and results, gives me grounds to express a positive assessment of the only candidate in the competition Chief Assist. Dr. Eng. Dimitar Borisov Borisov. I propose to the Faculty Council of the Faculty of Chemical and Systems Engineering of UCTM to approve him for the academic position of "Associate Professor" in the field of higher education 5 "Technical Sciences", professional field 5.13 "General Engineering", scientific specialty "Technologies and Systems for Environmental Protection" for the needs of the Department of "Environmental engineering" at UCTM, Sofia.

17.03.2026	The review was written by:	
date	**Assoc. Prof. Dr. Eng. Silviya Igorova Lavrova-Popova**	signature