

REVIEW

to occupy the academic position:

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

Candidates to occupy the position:

1	Associate professor	PhD	Nina	Yankova	Penkova	UCTM
№	academic position	scientific degree	name	middle name	last name	workplace
2						
№	academic position	scientific degree	name	middle name	last name	workplace

Scientific area:

5	Technical sciences
code	name

Professional area:

5.4	Energetics
code	name

Scientific specialty:

Industrial heat engineering

The competition has been announced:

37	21.04.2020	Silicate technology	Metallurgy and Materials Science
in SG issue	date	for the needs of the Department	Faculty

The review was written by:

Professor	Doctor	Emil	Georgiev	Michaylov	UCTM, Sofia
academic position	scientific degree	name	middle name	last name	workplace

1. Review for the candidate:

Associate professor	PhD	Nina	Yankova	Penkova
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 candidate, Assoc. Prof. PhD eng. Nina Yankova Penkova satisfies the minimum requirements for holding the academic position "Professor" according to the university and national regulations about the scientific field 5. Technical sciences

Assoc. Prof. PhD eng. Nina Yankova Penkova participates in the competition for the academic position "Professor" with a total of 52 scientific publications and one monograph. 19 papers have been printed and 5 papers are submitted for publication in journals, referred and indexed in world-famous databases. 28 papers are published in Bulgarian journals with scientific review and in edited collective proceedings.

There are 36 citations in scientific articles, one dissertation and one monograph.

The indicators of the candidate for the academic position "Professor" at UCTM are as follows:

- A (50 points) - Dissertation "Method for calculating of a regenerative heat exchanger with ceramic filling".

- B (100 points). A monograph on "Heat transfer at transparent structures in passive solar systems" is published by Academic Publications (ISBN 978-954-2940-25-8 Sofia, 2020, 122 pages). The monograph is prepared according to the requirements of the Regulations for acquiring scientific degrees and holding academic positions at UCTM.

- G (523 points at a required minimum of 200 points) - 24 scientific publications in publications referred and indexed in world-famous databases of scientific information (339 points) and 28 publications in non-refereed journals and collective proceedings with scientific review (184 points) are presented.

- D (284 at a required minimum of 100 points) - 240 points by citations and reviews in scientific journals, referenced and indexed in world-famous databases with scientific information, 24 by

citations in monographs and collective volumes with scientific peer review and 20 by citations and / or reviews in non-referred journals with scientific peer-review.

• E (278 points at a required minimum of 150 points). One PhD student was defended at the supervising of Assoc. Prof. Penkova (40 points). There are participations in one national educational project (10 points), one international educational project (20 points), managements of one scientific and one educational national projects (40 points). 151 points were formed as results of attracted funds by contracts, published university textbook and methodological instructions (17 points).

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	X
B) Research is relevant. Results from other authors are known for each of the topics and / or applications studied.	5 points	
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 activities of the candidate are in the following directions:

- energy and technological efficiency of thermal units and equipment;
- efficiency and reliability of passive solar systems.

The application of the results is related to reductions of energy consumption, increase of the capacity and quality of the produced products in industrial thermal installations, as well as to the utilization of the solar energy while providing heat comfort in the buildings.

Both areas are extremely relevant and priorities in national and European research and investment programs.

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.

The candidate analyzes, interprets, cites and creatively applies the results achieved by other researchers, applied and publishing activity. Additionally she contributes to the enrichment of theoretical knowledge and information in different areas of research.

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 realistic. They are achieved via complex and adequate modern research methods as mathematical modeling, industrial and laboratory experiments.

The candidate's researches have a scientific and scientifically-applied character – they are aimed at solving of real problems of the engineering practice.

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.

A wide range of methods, including mathematical modeling, industrial and laboratory experiments, have been used at the candidate's research work:

- mathematical modeling and numerical solution of the models by the finite volumes method (3, 4, 5, 6, 9, 10, 11, 13, 14, 17, 18, 20, 22, 23, 25, 26, 27, 28, 30 - 35, 37, 39, 46, 48, 49, 51, 53) and finite elements method (1, 2, 5, 7, 10, 12, 15, 16, 21, 24, 29, 38, 40 - 45, 47, 50, 52, 53);
- passive experiments at existing installations: passive solar systems (1, 4, 6, 7, 9, 26, 40, 53); industrial water heat accumulator (11, 31, 35), industrial drying installations (12, 15, 16, 24, 42, 45, 50, 52), industrial furnaces and combustion installations (13, 14, 17, 19, 21, 29, 30, 32, 33, 34, 37);
- experimental research in laboratory conditions: determination of the heat transfer coefficient and the mechanical processes at climatic loads of window systems by means of a standard test chamber (4, 10); determination of physical and mechanical characteristics of raw material for production of ceramics by laboratory drying and mechanical tests (12, 15, 16, 42, 45, 50, 52);
- processing of experimental data;
- balance calculations of drying installations (50, 52, 24), furnace units (12, 17, 37), floor heating for melting ice and snow (23, 48), logistics hall (22);
- design sizing of drying installations (24); furnace units (13, 14, 37); underfloor heating for melting ice and snow (23, 48);
- geometrical modeling of the distribution of solar energy in mutually visible large-area glazing using the methods of the analytical and descriptive geometry (2, 8, 40, 53).

Mathematical models are validated via experimental results. That is an evidence of mastery of different research approaches and good theoretical training. The goals set in the research are realistic and are achieved by adequate applications of modern research methods. One of the most powerful software for engineering research (ANSYS) has been mastered and actively used to conduct simulation researches.

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 research activities of the candidate are developed in the following directions:

- energy and technological efficiency of thermal units and equipment;
- efficiency and reliability of passive solar systems.

The contributions below have been achieved in these fields.

Energy and technological efficiency of thermal units and equipment

Scientific contributions

Algorithms have been developed and validated for:

- modeling and numerical study of non-stationary conjugate heat transfer in high-temperature chamber furnaces for firing ceramics, taking into account the combustion processes, radiation and convective heat exchange between multicomponent turbulent gas flows and solid medium in the furnaces, and the thermal conductivity in treated materials and furnace envelopes.
- modeling and numerical simulation of the coupled heat exchange, mass transfer and mechanical processes in capillary-porous colloidal materials during convective drying in industrial dryers. The hypothesis of the predominant influence of the mass transfer on the stress state of ceramic products at drying has been formulated and proved.

Mathematical models are developed of:

- the coupled heat transfer and mechanical processes in ceramic products during high-temperature firing, allowing numerical simulation of the thermo-mechanical behavior of a wide range of products in different modes. The model has been validated and its applicability has been proven by studying different temperature curves of firing of technical ceramics in order to prevent defects in the products.
- transient heat transfer and hydrodynamic processes in a two-phase, two-component environment of industrial water heat accumulators. The model allows optimizing the temperature stratification in the accumulators in order to increase their efficiency.

Scientific and applied contributions

- A solution for improving the heat transfer in a high-temperature chamber furnace for firing of technical ceramics through reconstructions of the heating unit and the combustion installation is proposed. That will increase the quality of the fired products and the energy efficiency of the installation.
- A potential for reducing the drying time of ceramic products in an industrial dryer has been established through model studies of the structural-diffusion processes in the material and balance dependences. This allows an increase of the capacity of the technological line.
- Models of heat exchange in thermo-probes for temperature measuring in bulk layers at various installation schemes and thermal loads are developed. They are applied to specify the materials and to determine the fire category and explosion safety of probes in order to certification.
- An algorithm for modeling and numerical study of heat transfer in outdoor areas with integrated fluid floor heating for melting snow and ice has been developed and verified. It allows predicting the possibility of local icing in different coil configurations, heating system capacities and climatic conditions. The algorithm is applied to study different configurations of underfloor heating in a road section.
- Concepts for modeling of the thermal and fluid flow processes in industrial halls are proposed. They are suitable for analysis of the temperature field and natural ventilation in the presence of buoyancy and wind pressure. The models were used to assess the infiltration in various combinations of open doors and flue hatches, and the need for additional heating capacity in a logistics hall.

Efficiency and reliability of passive solar systems

Scientific contributions

- A hypothesis that the non-stationary heat transfer in flat building glazing due to the daily variations of the external temperature and solar irradiation at a sufficient accuracy can be considered as a

sequence of steady states when analyzing the efficiency and reliability of structures is formulated and proved.

- Model studies of heat transfer and thermo-mechanical processes in bent glazing have been carried out for first time. The results allow analysis and evaluation of the temperature non-uniformity, the stress state of the glass and the potential for radiation asymmetry in the buildings.

Scientific and applied contributions

- Mathematical models for numerical study of heat transfer and thermo-mechanical behavior in flat double-glazed windows and window systems under standard test conditions have been compiled and validated. They allow analysis of the efficiency and reliability of such structures at a design stage.
- Algorithms for modeling and numerical study of thermo-mechanical processes in flat and curved transparent structures in passive solar systems have been developed and validated, taking into account the changing climatic conditions, solar irradiation and indoor microclimate parameters. They allow assessment of the efficiency and reliability of structures under operating conditions.
- Guidelines for precise selection of double glazing are formulated on the basis of model studies of the heat transfer, efficiency and reliability of various structures and configurations of insulating glass units and window systems at different spatial orientations and climatic conditions.
- A method for estimation of the utilized solar energy at large scale of transparent building envelopes, seeing each other is proposed.

Applied and educational contributions

- A Center for Mathematical Modeling and Computer Simulation (CMMCS) was established at UCTM as a result of the implementation of a national project under the leadership of the applicant.
- Two laboratories for modeling and computer simulation of processes and for validation and verification of model studies have been established as results of the implementation of national projects under the guidance and with the participation of the applicant.
- Five new master courses and correspondent teaching materials with theory and guidelines for laboratory exercises been developed.
- Adapted methodologies for balance calculations, analyses and improvements of the efficiency of industrial and renewable energy systems have been developed.
- A methodology for determining the energy effect of glazing of terraces has been developed. It is used to define energy saving measures at energy audits of multi-family residential buildings and to subsequent financing and implementation of the activities.
- Energy managements of the heat supply of educational buildings A, B and C of UCTM has been introduced, which leads to an average reduction of the energy costs for heating of the buildings by 30%.

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.

It is assumed that the candidate has at least equal participation in the submitted works due to the lack of distribution protocols between the authors. She is the first author of more than 50% of the papers Taking into account the topics of the publications it can be told that assoc. prof. Penkova has a leading role in the most of them.

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.

Assoc. prof. PhD eng. Nina Penkova leads the following lecture courses in UCTM:

- "Thermal Engineering", "Thermal processes and equipment in the silicate technologies", and "Renewable energy sources" for Bachelor's degree;
- "Energy efficiency of processes and products for RES" (in English), Modeling and computer simulation of technological processes", "Introduction to computer simulation of processes", "Computer simulation of hydrodynamic processes", "Industrial thermal devices - design and CAE analysis" for Master students.

Assoc. Prof. Dr. Eng. Nina Penkova is the scientific supervisor of 4 PhD students in PF 5.4. Energetics, specialty "Industrial Heat Engineering". One of them has successfully defended a dissertation on "Improving the heat transfer in high-temperature chamber furnaces for firing of ceramics".

She is the author and co-author of the following textbooks:

- Thermal units in the silicate industry, 2011;
- Methodical guidelines for conducting an inspection of enterprises for energy efficiency, incl. SMEs, assessment of energy savings in order to obtain a certificate of energy savings, 2019;
- Modeling and computer simulation of thermal and fluid flow processes", 2017
- Investment design, 2018.

She is the author of 7 master courses (2 of them are in English).

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

I give a positive assessment and propose to the scientific jury to accept and evaluate positively the candidacy of assoc. prof. PhD. eng. Nina Yankova Penkova for the academic position "Professor" in the scientific specialty "Industrial Heat Engineering", professional field 5.4. Energetics, field of higher education 5. Technical sciences.

Candidate ranking (in case of more than one candidate who has received a positive evaluation to occupy the academic position):

Based on the assigned points, the candidates who have received a **positive** evaluation are ranked as follows:

1	Assoc. prof.	PhD	Nina	Yankova	Penkova	95
place	academic position	scientific degree	name	middle name	last name	points
2						
place	academic position	scientific degree	name	middle name	last name	points
3						
place	academic position	scientific degree	name	middle name	last name	points

	The review was written by:	
date		signature