REPORT

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	Assoc. Prof.	PhD	Juliana	Javorova	Georgieva	UCTM
№	academic position	scientific degree	name	middle name	last name	workplace

Scientific area:

5	Technical sciences
code	name

Professional area:

5.1	Mechanical Engineering
code	name

Scientific specialty:

Applied Mechanics (incl. Tribology) with teaching in German

The competition has been announced:

39	27.05.2022	Applied mechanics	FMMS
in SG issue	date	for the needs of the Department	Faculty

The report was written by:

Prof.	PhD	Lachezar	Zhivkov	Stoev	TU - Sofia
academic position	scientific degree	name	middle name	last name	workplace

1. Report for the candidate:

Assoc. Prof.	PhD	Juliana	Javorova	Georgieva
academic position	scientific degree	name	middle name	last name

1.1. 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. Juliana Javorova Georgieva, meets the minimum requirements for holding the academic position "Professor", regulated in PPZRASRB and PPNSZAD in HTMU, Sofia in scientific field 5. Technical sciences. According to the indicators of groups B, G, D and E, her works *significantly exceed* the required minimum number of points.

The indicators of the candidate for the academic position "Professor" at HTMU, by individual groups, are as follows:

• A (**50** points, required 50 points) - Dissertation for awarding the educational and scientific degree "doctor".

• B (**264** points, minimum 10 publications required) - Assoc. Prof. Javorova has provided **12** publications for review, which are equivalent to a habilitation work. They are published in editions that are referenced and indexed in world-renowned databases with scientific information.

• G (**407.86** points, required 200 points) - **9** scientific publications are presented in editions that are referenced and indexed in worldwide databases with scientific information (**117.32** points), and **33** publications in non-refereed journals with scientific review or in edited proceedings (**290.54** points).

• D (**769** points, required 100 points) - The points are achieved as follows: **450** points from **45** citations, in scientific publications, refereed and indexed in world-renowned databases with scientific information, **93** points for **31** citations in monographs and peer-reviewed collective proceedings, **40** points from citations in non-refereed peer-reviewed journals and **186** points for **25** reviews.

• E (**245** points, required 100 points) Assoc. Prof. J. Javorova is the sole supervisor of a successfully defended PhD student (**40** points). The other points collected according to the relevant indicators from this group are the following: from participation in national scientific or educational projects (**40** points), from participation in international scientific or educational projects (**60** points), management as head of one international scientific or educational project (**40** points), attracted funds for projects led by the candidate (**25** points), published university textbook or a textbook that is used in the school network (**20** points) and a published university handbook or a handbook that is used in the school network (**20** points).

1.2. 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)	8 points	X

B) Research is relevant. Results from other authors are known for each of the topics and / or applications studied.	6 points	
C) Most of the research is relevant, but also some results are presented that have no scientific and / or applied value	4 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 presented scientific publications and research developments are up-to-date and significant for the development of science, practice and education in the field of the competition. The candidate is a respected scientist and a recognized researcher in our country and abroad. The quantitative indicators of the criteria for occupying the academic position "professor" have been exceeded.   From the information provided about refereed and indexed scientific works of Assoc. Prof. J. Javorova in world-renowned databases and from the attached numerous citations, it is clear that her publications are of interest to foreign and Bulgarian researchers. This is sufficient evidence of their relevance and importance. The following sections of this report indicate the main research directions, the achieved objectives and the contributions of the author's research, which confirm my assessment of the relevance of the research.

1.3. 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 goals of the author's current scientific research (in the five main directions indicated in the following section 1.4) are aimed at: - creation of new mathematical models of the lubrication of hydrodynamic journal bearings;   - study of the influence of nanocomposite and other coatings on the wear of various details and tools;   - development of a new mathematical model for determining the laws of motion and trajectories, velocities and accelerations of golf and soccer balls.   The new models have scientific contributions in the respective fields. The rest of the author's research is of a marked scientific-applied and applied nature and contributes to

finding industrial solutions to reduce the wear of details and tools treated with nanocomposite and other coatings.

1.4. Candidate research contributions:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	X
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	
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 scientific research activity of the candidate is concentrated in the following *five main directions*: hydrodynamic lubrication of journal bearings, biotribology, friction and wear in various tribological systems, study of mechanical and tribological characteristics of various materials and solutions to specific problems in the field of Theoretical mechanics.
The main scientific, scientific-applied and applied contributions are the following:

- The influence of the inertia forces of a lubricating fluid in the bearing clearance of a hydrodynamic journal bearing has been established. The effect of the micro-asperities of the friction surfaces on the values and distribution of the hydrodynamic pressure in the oil film of the bearing was also determined.

- The modified nonlinear Reynolds equation for a finite-length bearing is derived for the case of a pseudoplastic or dilatant fluid described by the cubic model of a non-Newtonian lubricant.

- A mathematical model of an EHD bearing, lubricated with a non-Newtonian fluid, described by the Rabinowitsch model, was created.

- A mathematical model of a journal bearing with finite dimensions has been developed, taking into account the inertial and turbulent effects of the lubricating fluid in the conditions of elastic contact.

- A generalized Reynolds equation for the hydrodynamic pressure in the fluid film, the elasticity theory equation for the contact deformations of the coating and the differential equations of motion of a rigid balanced rotor at small displacements of the shaft center from the stable equilibrium position are simultaneously solved.

- An experimental test rig of a journal bearing with replaceable bushings with different mechanical characteristics of the material was created to account for the effect of coating deformability.

- A new model for the lubrication of the hip joint with hyaluronan solutions is proposed, considering the lubrication process with a non-Newtonian fluid between rigid spherical surfaces.

- In the conditions of dry reciprocating friction, comparative tribological studies were carried out on the metals brass and bronze, as well as on various polymer composites. It has been proven that composite materials (reinforced with Cu, Zn and Sn particles) have reduced wear and are recommended for repair activities to restore worn or damaged parts.

- The influence of the nanocomposite coating Ti/TiN/TiCN/nc-TiCN:aC/ncTiC:a-C/a-C on steel 1.2343 for injection molds was established depending on the initial roughness and hardness of the experimental samples. A significant reduction in wear of hardened and polished parts coated with the composite nanomaterial has been proven.

- Reduced wear of HVOF-coated drilling tools in the mining industry has been experimentally found compared to untreated ones.

- Reduced tooth wear on milling tools that have an anti-wear coating applied has been proven experimentally.

- It was established that the addition of small amounts of nanodiamonds in elastomeric mixtures (of the type of rubber and rubber products) containing dehydrogenated hydrocarbons leads to an improvement of the elastohysteresis properties of the vulcanizates.

- Increasing the concentration of a studied polymeric viscosity-index thickening additive in mineral oil was found to increase shear stress and viscosity. As the shear rate increases, there is a decrease in viscosity and an increase in shear stress.

- An original program has been developed for the three-dimensional study of the flight of a ball (for golf or soccer), deriving the law of motion and determining the velocities and accelerations along all coordinates, as well as the projections of the trajectory on the three coordinate planes. The presented results can be used in the field of fluid overflow of bodies.

- A mathematical model of the flight of sports balls (for golf and soccer) was created, including the equations of kinematics, dynamics and fluid mechanics. All possible kinematic characteristics of ball flight are determined, such as law of motion, linear and angular velocities, linear and angular accelerations and trajectories. Based on the analysis of the results, the recommended values of the initial parameters for the successful execution of corner and direct free kicks in football have been calculated.

- An inhomogeneous differential equation is derived to determine the transverse oscillations of a *polymer-concrete* cantilever beam. The created model allows identification of the modulus of elasticity of the beam material.

1.5. 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.
Assoc. Prof. Javorova has a sufficient number of single-authored publications and others in which she is the first author. Due to the lack of distribution protocols between the authors, I assume that the candidate has at least equal participation in the presented works.

1.6 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.
This is a good place to mention that they impressed me positively: - The language skills of Assoc. Prof. Javorova, who teaches basic courses at HTMU *in English and German languages*. This is characteristic of a small number of the university professors I know, and it deserves admiration. - The textbook provided for opinion is distinguished by precisely formulated explanations and aesthetically designed colorful figures and embedded formulas.

1.7. 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.
In the summaries of the main results and contributions of the applicant's papers provided to me, an inaccuracy was made regarding the effect of increasing the feed in unidirectional

milling on reducing the occurrence of "chipping of the tool". Increasing the rotation frequency of the milling tool in unidirectional milling, rather than the feed, reduces the cross-section of the shear layer and the force load on the teeth. This is the reason for the expected reduced tool wear found.

Recommendation for possible future research: Assoc. Prof. Javorova has gained experience in researching the flight of sports balls for golf and soccer. If interested and willing on her part, she could direct her (or her doctoral students) future research to determine the trajectories of a snooker or billiard ball depending on the point and force of concentration of the initial shot. The law of motion in this case is also of interest when the rotating ball is in contact with the edge of the table or with another ball when taking into account the tribological influencing factors. The results of such research will be of benefit to amateurs and professionals practicing this sport. Analogous studies would be interesting for other sports, such as tennis or table tennis, volleyball and others. For specialists ***with combined knowledge in the fields of mechanics and tribology***, this could be a new and interesting direction for scientific modeling in the field of various sports with serious prize funds from competitions that delight millions of fans around the world.

1.8. Conclusion

A) The evaluation of the candidate's activity is **POSITIVE**	This evaluation is assigned to a total number of at least 50 points	X
B) The evaluation of the candidate's activity is **NEGATIVE**	This evaluation is assigned to a total number below 50 points	
		one of the answers given is marked with the sign "X"

To be filled in if requested by the member of the scientific jury
After familiarizing myself with the publications and materials provided for the competition, I can share my conviction that the research and the results achieved are the author's personal work. I positively assess their scientific, scientific-applied and applied value. The results of the research prove the competence of Assoc. Prof. Javorova.   Bearing in mind the relevance and significance of the achieved scientific, scientific-applied and applied contributions of the works, I consider that the requirements of the ZRASRB and the Regulations for its implementation in the HTMU Sofia have been met. This gives me the reason to give a **positive evaluation** of the works provided to me. **I consider it justified to propose to the respected Scientific Jury Assoc. Prof. PhD Eng. Juliana Javorova Georgieva to occupy the academic position "Professor"** in the scientific specialty "Applied Mechanics (incl. Tribology) with teaching in German", professional field 5.1 "Mechanical Engineering ", field of higher education 5. Technical sciences.

19.08.2022 г.	The report was written by:	
date	Prof. PhD Eng. Lachezar Zhivkov Stoev	signature