

**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 | Assoc. prof.      | PhD               | Dimitar | Ivanov      | Pilev     | UCTM      |
| № | academic position | scientific degree | name    | middle name | last name | workplace |

**Scientific area:**

|      |   |
|------|---|
| 4    | Natural sciences, mathematics and informatics |
| code | Scientific specialty                          |

**Professional area::**

|      |                                  |
|------|----------------------------------|
| 4.6  | Informatics and Computer Science |
| code | name                             |

**Scientific specialty:**

|             |
|-------------|
| Informatics |
|-------------|

**The competition has been announced:**

|             |            |                                 |  |
|-------------|------------|---------------------------------|--|
| 23          | 19/03/2024 | Informatics                     | Faculty of Chemical and System Engineering |
| in SG issue | date       | for the needs of the Department | Faculty                                    |

**The review was written by:**

|       |     |      |         |        |                    |
|-------|-----|------|---------|--------|--------------------|
| Prof. | PhD | Asen | Kanchev | Rahnev | Paisii Hilendarski |
|-------|-----|------|---------|--------|--------------------|

|                      |                      |      |                |           |                          |
|----------------------|----------------------|------|----------------|-----------|--------------------------|
|                      |                      |      |                |           | University<br>of Plovdiv |
| academic<br>position | scientific<br>degree | name | middle<br>name | last name | workplace                |

### 1. Review for the candidate:

|                      |                      |         |             |           |
|----------------------|----------------------|---------|-------------|-----------|
| Assoc.prof.          | PhD                  | Dimitar | Ivanov      | Pilev     |
| academic<br>position | scientific<br>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 | <b>x</b>   |
| B) he 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" |

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| Missing documents and violated requirements must be described if response C is marked  |
| The documents submitted by the candidate for the competition for the academic position of "Professor" fully comply with the requirements of the Regulations for the Acquisition of Scientific Degrees and the Holding of Academic Positions at the University of Chemical Technology and Metallurgy – Sofia. |

#### 1.2.Meeting the minimum requirements under the Regulations:

|  |           |  |
|--|-----------|--|
| A) The candidate meets the minimum requireme           | 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. Therresponse of the results achieved (quoted) is analyzed. |
| The publications are in international conferences and journals, referenced and indexed in   |

world-famous databases - 6 publications with impact factor ( 5 in Q2 and 1 in Q3); 3 with impact rank and 4 publications referenced in Scopus.

The total number of citations is 27, published in publications referenced and indexed in WoS and Scopus.

According to the provided reference, Assoc. Prof. Pilev has an extensive teaching activity. Only in the last academic year, he has conducted 7 lecture courses, authored 10 educational programs.

The candidate has participated in a total of 12 research projects - 3 national, 1 international, and 8 university-based.

The candidate's works meet and exceed the minimum requirements for holding the academic position of "Professor," according to the Regulations for the Acquisition of Scientific Degrees and Holding of Academic Positions at the UCTM.

| Group of indicators                  | requirements | performance |
|--------------------------------------|--------------|-------------|
| Indicator 1                          | 50           | 50          |
| Indicator 2                          | -            |             |
| Indicator 3 or 4                     | 100          | 210         |
| Sum of indicators from 5 to 10       | 200          | 297         |
| Sum of indicators 11.1 and 11.2      | 100          | 216         |
| Sum of indicators from 12 to the end | 100          | 120         |

### 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 |   |

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|  |  | one of the answers given is marked with the sign "X" |
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|---|
| The evaluation of the relevance of the research must be substantiated   |
| <p>The candidate's research is up-to-date and spans the following main areas:</p> <ul style="list-style-type: none"> <li>• Mathematical modeling and optimization of processes in petroleum refining;</li> <li>• Intelligent methods for determining emotional states and early diagnosis of mental health issues (such as depression, anxiety, etc.);</li> <li>• Cyber-physical security;</li> <li>• Application of AI for solving current engineering problems.</li> </ul> <p>Despite the short time since publication, the number of citations confirms the relevance of the research.</p> |

**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" |

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| The evaluation must be substantiated if answer C is marked   |
| The candidate has a deep understanding of the subject matter, as evidenced by the publications submitted for the competition. A detailed analysis of the state of each of the issues under consideration is available. |

**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" |

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|---|
| The level of research must be substantiated if answer D is marked.  |
| The candidate's presented research is both scientific-applied and practical nature. A significant part of the developments have been applied in the petroleum refining process. |

### 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 set goals are realistic, professionally motivated, and represent scientific and/or applied interest. They have been achieved through the application of modern research techniques and methodologies. Based on the research, significant scientific and applied contributions have been made, which are of substantial importance in addressing specific production challenges. |          |  |

### 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 |   |

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|  |  | one of the answers given is marked with the sign "X" |
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| Methods must be specified. The type of methods used is justified.  |
| The methods used by the candidate are appropriate and fully aligned with the set goals: <ul style="list-style-type: none"> <li>• Multi-criteria analysis;</li> <li>• InterCriteria analysis;</li> <li>• Linear regression analysis;</li> <li>• Non-linear regression analysis;</li> <li>• Correlation analysis;</li> <li>• Image classification with logistic regression;</li> <li>• Image classification with k-nearest neighbors;</li> <li>• Image classification with artificial neural networks;</li> <li>• Newton's method;</li> <li>• SARA analysis;</li> <li>• HTSD analysis;</li> <li>• Riazi distribution model.</li> </ul> |

**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 interes   | 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" |

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| Contributions must be specified. The type of results achieved must be justified  |
| The candidate's contributions are categorized by thematic areas:<br><b>Mathematical modeling and optimization of processes in petroleum refining</b> |

### Scientific and Applied Contributions

- Models for predicting the conversion level of vacuum residue under different operating conditions were developed. It was found that the plug-flow reactor model with an activation energy of 215 kJ/mol and a reaction order of 1.59 provides the highest accuracy of vacuum residue conversion with an average absolute deviation of 2.2%;
- Three new empirical correlation models, as well as three models using a modified iterative Newton method, were presented for predicting the refractive index of petroleum fluids based on density, boiling point, and SARA fractional composition;
- A multi-criteria analysis based on intuitionistic fuzziness and index matrices was proposed to evaluate the data for the hydrocracker processing of vacuum residue in the H-Oil ebullated bed, aimed at identifying the causes of increased fouling observed during the third cycle of H-Oil hydrocracking;
- A procedure for simulating petroleum TBP (True Boiling Point) curves from HTSD (High-Temperature Simulated Distillation) data was developed using nonlinear regression and the Riazi distribution model;
- A new correlation model was implemented, predicting the saturated petroleum content from specific gravity and pour point with a mean absolute deviation of 2.5 wt.%, a maximum absolute deviation of 6.6 wt.%, and a bias of 0.01 wt.%;
- Tests were conducted on 21 existing empirical correlation models regarding their ability to predict viscosity. It was confirmed that the viscosity of a heavy oil blend decreases exponentially with the increasing concentration of the diluent;
- It was confirmed that the approach based on an artificial neural network (ANN) provides higher accuracy in predicting the viscosities of heavy oil and diluent mixtures compared to empirical correlation models.

### **Intelligent Methods for Determining Emotional State and Early Diagnosis of Mental Health**

#### Scientific and Applied Contributions

- Known pre-trained models used for facial emotion recognition have been analyzed. These models have been employed to enhance the student learning process based on their facial emotions during online lectures or exercises;
- A hybrid multimodal model has been proposed for recognizing human emotions based on facial expressions and body language. Pre-trained BER and FER models have been utilized for this purpose. A decision-making module has been introduced, skillfully combining the results from 26 BER and 7 FER emotions;
- The development presented in the previous point has been further refined through a so-called bimodal model, capturing facial emotions in combination with

meteorological conditions. The model is applicable for detecting the early stages of certain mental illnesses, as well as for determining the impact of weather on people's emotional states.

### **Cyber-Physical Security**

#### Scientific and Applied Contributions

- A new cyber-physical security system has been proposed featuring facial recognition, incorporating a neural network and intelligent algorithms to assess the severity levels of security breaches;
- Threat severity levels ranging from 1 (low severity) to 4 (critical) have been presented, based on facial recognition and data from carbon dioxide and temperature sensors.
- ANN have been trained to evaluate the level of threat.

#### Applied Contributions

- A dataset has been collected and utilized for training neural networks in cyber-physical security systems;
- A program code implementing the functionality of a cyber-physical security system, as well as the associated graphical user interfaces, has been developed

### **Others**

#### Scientific and Applied Contributions

- Statistical models have been developed to determine the red color, polyphenol content, flavonoids, and anthocyanins in wine (red or rose);
- A regression model has been developed to the modeling of hour-by-hour concentrations of PM<sub>10</sub> in Sofia, depending on the meteorological indices such as temperature, humidity, wind speed, radiation, and pollutant.

### **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" |
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Critical notes must be provided if one of the items C or D is marked

All of the candidate's articles are co-authored. Authorship agreements have not been presented. Therefore, I assume that he has at least equal participation in the submitted papers.

The candidate is the sole author of the teaching aid submitted for the competition.

**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 C or D is marked

For the last academic year, the courses taught by Assoc. Prof. Pilev are as follows:

- "Informatics Part I" – regular education, Bachelor's degree, winter semester, 30 hours;
- "Internet Information Systems and Databases", regular and part-time education, Master's degree, winter semester - 15 hours (elective course for Master's students);
- "Informatics Part II", regular education, Bachelor's degree, summer semester, 15 hours;
- "OOP with Java Part I", regular and part-time education, Master's degree, winter semester - 20/10 hours;
- "OOP with Java Part II", regular and part-time education, Master's degree, summer semester, 20/10 hours;
- "Informatics Part I" – regular education (in English), Bachelor's degree, winter semester, 30 hours;

- "Informatics Part II", regular education (in English), Bachelor's degree, summer semester, 15 hours.

Study materials are prepared and available for all courses in the UCTM e-learning platform.

According to the provided documents, the candidate has developed 10 curricula for Bachelor's and Master's degree students.

### 1.11. Critical notes:

|   |          |  |
|---|----------|--|
| A) Lack of critical notes   | 8 points | x  |
| 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 |  |
| 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

I have no critical notes regarding the candidate's scientific and teaching work. The documents have been presented correctly, and the requirements for the various indicators have been met.

### 1.12. Conclusion

|  |   |                  |
|--|---|------------------|
| A) The evaluation of the candidate's activity is <b>POSITIVE</b> | This evaluation is assigned to a total number of at least 65 points | X<br>(93 points) |
| B) The evaluation of the candidate's activity is <b>NEGATIVE</b> | This evaluation is assigned to a total number below 65 points       |                  |

|  |  |  |
|--|--|--|
|  |  | one of the answers given is marked with the sign "X" |
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| To be filled in if requested by the reviewer |
|  |

|            |                            |           |
|------------|----------------------------|-----------|
|            | The review was written by: |           |
| 29.07.2024 | Prof. Asen Rahnev          | signature |