Program

Name of discipline Methodology of scientific research

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Recommended for direction (s) of training (specialty (s))

Qualifications (degree) _____ Magister____

1. Course description

1. **Name: «Methodology of scientific research»**
2. **Aims and objectives of the course: The objectives** of the discipline (module) "Methodology of scientific research" are as follows: study of the laws, principles, systems, innovative approaches, forms, methods and means of scientific creativity; the formation of scientific research, professional competence of magisters, consider the issues of formulating and solving scientific problems in the vocational education system.

To do this, the following **tasks** must be solved:
- To learn the new research methods,
- Master the solution of research tasks,
- Learn how to search and analyze the profile of scientific and technical information needed for specific tasks, including the implementation of interdisciplinary projects.

2. Brief description of the course:

The course is designed to provide knowledge on basic methods of scientific creativity, for the collection of the application of existing techniques, methods and skills of observation, experimentation, and the processing of the results, according to the material and technical base and normative documents that exist on the subject.

The course has a scientific-theoretical and practical purpose. Course duration - 1 semester. The course is based on the knowledge gained in the study of mathematics, logic, philosophy, psychology, sociology, general ecology, culture, probability theory, statistics, biology, chemistry, computer science.
The course is theoretical, compulsory for study. The complexity of 2 credits (72 hours).

3. **As a result of the studying of the discipline the student should / will:-**
Know:
• basic laws of scientific knowledge development;
• mechanisms that influence the formation of methodological principles of scientific paradigms;
• concept of creativity;

- Be able to:
• formulate a research problem;
• identify and schematize cognitive methods in accordance with the stated problem;
• plan the scientific research in accordance with the stated problem;
• use the methodological approaches for the analysis of specific scientific fields.
- Can:
• use methods of creative thinking stimulation;
• use the skills of organizing and conducting scientific discussion.

5. General structure of the course / module (indicating the number of hours of classroom / independent work):

The course includes 9 lectures - 18 hours, practical lessons - 18 hours; independent work of the student -36 h, interim attestation- 2 h, end-of-course assessment- 2 h.

DETAILED SUBJECT SYLLABUS

Theme 1. Concept of Science.

1.1. Concept of Science. 1.2. The big fields of the Science. 1.3. Divisions and branches of the sciences. 1.4 Basic Sciences. 1.5 Applied Sciences

Theme2. **Development of the Science across the time**.

2.1. Historical - scientific frame. 2.2. The Genesis of the scientific thought. 2.3. Types prescientific of knowledge.2.4. Rational speculation and origin of the natural science.

Theme3. The scientific method.

3.1. Methods of the Science: analysis and synthesis, induction and deduction. 3.2. Characteristics and limitations of the scientific method. 3.3. Formal systems, models and interdisciplinary knowledge.

Theme4. Information.

4.1. **Quality** & **quantity** features, 4.2. Classification of information. 4.3. Categories of articles in scientific journals. 4.4. Bradford's law. 4.5. Duplication of researches. 4.6. Subsequent steps of a literature search. 4.7. Key Words. 4.8. Relevant and pertinent documents. 4.9. Types of search with searching machines.

Theme5. Introduction to the research; Variables.

5.1. Independent, dependent & confounding variables. 5.2. Choosing the Measurement. 5.3. Types of validity. 5.4. Reliability. 5.5. Sampling Groups to Study.

Theme 5. Creating the Design of research.

5.1. Qualitative versus Quantitative. 5.2. Empirical methods 5.3. Observation. 5.4. Experiment

Theme 6. The observation like source of the Science.

6.1. The observation and the empirical science. 6.2. Features of scientific observation. 6.3. Intersubjectivity and objectivity. 6.4. Can an Observation Be Wrong? 6.5. Repeatability. 6.6. Types of observations. 6.7. Design a system for data collection. 6.8. Disadvantages of observation.

Theme7. Experiment

7.1. Typical Designs and Features in Experimental Design. 7.2. Central Tendency and Normal Distribution. 7.3. Calculating Experimental Errors. 7.4. Probability and Statistics. 7.5. Mean and Standard Deviation. 7.6. Reporting the Results of an Experimental Measurement.

**Theme8. Surveys and Questionnaires **

8.1. Interviews 8.2. Surveys. Types of Survey Questions. Pilot Survey. 8.3. Rating Scales. 8.4. Survey Response Formats. 8.5. Constructing Survey Questions.

Theme9. Righting a paper

9.1. Title. 9.2. Summary (Abstract). 9.3. Key words. 9.4. Introduction. 9.5. Material and Methods. 9.6 Results and discussion. 9.7. General considerations and conclusions. 9.8 Bibliographical References

Theme10. Research, Development and Scientific Innovation.

10.1. Concept. 10.2. Big inventions and inventors. 10.3. Development. 10.4. Innovation. 10.5. Patents. 10.6.Economic aspects. 10.7. Informational efficiency of the research.

Theme11. Social responsibility of the scientist.

11.1. Responsibility in the application of the scientific method. 11.2. Scientific fraud. 11.3. The scientist like conductive force of the progress of the knowledge.

CLASSES PRACTICES / SEMINARS

1. Choose a topic for the research.

2. Previous search of sources of information.

3. Selection of methodological procedures.

4. Create a matrix for the expert method of research..

5. Calculate the informational efficiency of the previous work of the student.

READING & INFORMATION SOURSES

1. Gauch, H.G. (2003). Scientific method in practice. Cambridge University Press, UK.

2.Insight Media. (2010). How to Read and Understand a Research Study; Research Design: The Experiment;Research Design: The Survey; Research Ethics. DVDs of Science.Insight Media, New York, US.

3.National Academy of Sciences (U.S.).Committee on the Conduct of Science, National Academy of Engineering(1995).On being a scientist: responsible conduct in research. NationalAcademiesPress, WashingtonDC.

4. Wilson, E.B. (1991). An introduction to scientific research.McGraw-Hill, NewYork.

RECOMMENDED INTERNET LINKS

1. Scientific Method: http://emotionalcompetency.com/sci/booktoc.html

2. Science Fair Project Ideas: http://www.sciencebuddies.org/

http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml

3. An Introduction to Science: Scientific Thinking and the Scientific Method: http://www.freeinquiry.com/intro-tosci.html

4. Introduction to the Scientific Method: http://teacher.nsrl.rochester.edu/phy_labs/AppendixE/AppendixE.html

5. The Scientific Method: A helpful guide by Science Made Simple:

http://www.sciencemadesimple.com/scientific_method.html

5. Practical Assessment, Research & Evaluation, Vol 12, No 10 8 Hsu & Sandford, Delphi Technique.
6. Fred Stern, Marian Muste, Maria-Laura Beninati, and William E. Eichinger SUMMARY OF EXPERIMENTAL UNCERTAINTY ASSESSMENT METHODOLOGY WITH EXAMPLE The University of Iowa, 1999
7. Mike Sondalini Understanding How to Use The 5-Whys for Root Cause Analysis www.lifetime-reliability.com
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