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Karaganda Technical University named after Abylkas
Saginov

Academic Council

Protocol № 11

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THE PROGRAM OF THE ENTRANCE EXAM FOR APPLICANTS TO
DOCTORAL STUDIES IN EDUCATIONAL PROGRAM
8D07102 "Transport, transport equipment and technologies"

Department: " Transport equipment and logistics systems "
Compiled by:
c.т.s, doc. Kabikenov S.J.
c.т.s, doc. Aubekerova Zh.N.
PhD, acting associate professor
Kyzylbayeva E.Zh.

Karaganda 2024

The list of exam subjects for admission to the doctoral program according to the educational program 8D07102 – "Transport, transport equipment and technologies"

	The name of the disciplines according to the working curriculum 7M07104 - "Transport, transport equipment and technologies"	Number of credits / number of questions	Recommended literature
1	**Module 1** Disciplines 1. Technical operation of transport equipment; 2. Assessment and forecasting of reliability indicators of transport equipment; 3. Organization of scientific research	5/5/5 50	Questions
2	**Module 2** Disciplines 1. Technical operation of transport equipment; 2. Assessment and forecasting of reliability indicators of transport equipment; 3. Organization of scientific research	5//5/5 50	Questions
3	**Module 3** Disciplines 1. Technical operation of transport equipment; 2. Assessment and forecasting of reliability indicators of transport equipment; 3. Organization of scientific research	5//5/5 50	Questions

The subjects of the disciplines "Technical operation of transport equipment", "Assessment and forecasting of reliability indicators of transport equipment", " Organization of scientific research "
for the 1st module

1. Forms and methods of organisation of production of maintenance and repair of TE.
2.What strategies are available to ensure the serviceability of transport equipment?
3. What constitutes concentration, specialisation and centralisation of production?
4.Constructive parameters, diagnostic parameters, their connections, diagnostic standards.
5. What do errors of the 1st and 2nd kind mean in diagnosis?
6. Formation of the wage fund of the complex brigade for maintenance and repair of transport equipment.
7. Distribution of the wage fund of the complex brigade for maintenance and repair of transport equipment.
8. Readiness coefficients, technical availability coefficients, release coefficients, technical utilisation coefficients.
9. Connection of availability factor to reliability indicators.
10. Characterise the requirements for diagnostic parameters.
11. Wheel imbalance and ways to eliminate it.
12. Tire maintenance and repair.
13. Basic methods of starting engines at low temperatures.
14. Factors determining tyre life.
15. Factors determining tire life.
16. What factors determine the effectiveness of technical operation.
17. What physical and chemical properties characterize the quality of lubricants
18. The rate of labor intensity of maintenance and repair operations
19. Causes of loss of TE performance
20. Fractures and damages of TE parts in the absence of friction
21. Methods of evaluation of TE reliability
22. Prediction of CT reliability at the stage of TE design
23. Prediction of CT reliability at the stage of production
24. The life cycle of a TE.
25. Ensuring the reliability of TE at the design stage.
26. Ensuring the reliability of TE at the production stage.
27. Ensuring the reliability of TE in operation.
28. Physical processes that cause a decrease in the serviceability of TE in operation.
29. Technological factors affecting the nature and intensity of wear of machine elements.
30. Fretting corrosion of metals and measures to protect parts from fretting corrosion.
31. Operational factors affecting the nature and intensity of wear of machine elements, as well as measures to reduce wear of machine parts during operation.
32. Design factors affecting the nature and intensity of wear of machine elements, as well as measures to reduce wear of machine parts in their design.
33. Types of additives.
34. Describe the requirements for engine oils.
35. Science as a system of knowledge. Fact, hypothesis, theory, concept.
36. Classification of methods of scientific research.
37. Methodology of theoretical research.
38. Methodology of experimental research.
39.Properties of scientific thinking.
40. Give a description of empirical and theoretical methods.
41. Methods of analysis. Classification of methods of analysis used in research.
42. What are the stages of scientific research, disclose them.
43. General lological methods of research.

44. Give a description of the theory of similarity.
45. Give a description of dimensionality analysis.
46. Basic methods of forecasting.
47. Give a description of morphological analysis.
48. Give a description of factographic methods
49. Describe expert methods.
50. Scientific hypothesis: types, functions, stages of development

List of recommended literature:

1. Osnovy tehnicheskoi ekspluatatsii transportnoi tehniki / S.J. Kabikenov, T.S. İntykov, M.M. Kirievskii, V.V. Şalaev ; Karagandinskii gosudarstvennyi tehnicheskii universi- tet. -Karaganda.: İzdatelstvo KarGTU. 2015.-261 s.
2. Osnovy tehnicheskoi ekspluatatsii transportnoi tehniki / S.J. Kabikenov, T.S. İntykov, M.M. Kirievskii, V.V. Şalaev ; -Almaty: İzdatelstvo Evero. 2018.-312 s.
3. Kuznetsov E.S. Tehnicheskaya ekspluatatsiya avtomobilei.: Uchebnik dlya vuzov. 4–e izd. pere-rab. i dopoln. / E.S. Kuznetsov, A.P. Boldin, V.M. Vlasov i dr. –M,: Nauka. 2001. - 535 s.
4. Optimizatsiya i upravlenie pri tehnicheskoi ekspluatatsii avtomobilei. / J.A. Aliev J.A., S.J.Kabikenov, M.M. Kirievskii : Uchebnoe posobie: - Karaganda: KarGTU, 2000. – 210 s.
5. Şişmarev V.Yu. Nadejnost tehnicheskih sistem. - M.: İzdatelsk. Tsentr «Akademiya», 2010. – 271s.
6. Zorin V.A. Osnovy rabotosposobnosti tehnicheskih sistem: uchebnik dlya studentov vys- şih uchebnyh zavedenii. – M.: İzdatelskii tsentr «Akademiya», 2009.- 208s.
7. Otsenka nadejnosti tehnicheskih sistem: ucheb. posobie / A.S. Şirşikov, V.V. Lyandenburskii, A.M. Belokovylskii. – Penza: PGUAS, 2015. – 240 s.
8. Ludchenko A.A., Ludchenko YA.A., Primak T.A. Osnovy nauchnyh issledovanii: Ucheb. posobie / Pod red. A.A. Ludchenko. — 2-e izd., ster. — K.: Ovo "Znaniya", KOO, 2001. — 113 s.
9. Osnovy nauchnyh issledovanii: Uchebnoe posobie / V. M. Kojuhar. — M.: İzdatelsko- torgovaya korporatsiya «Daşkov i K°», 2010. — 216 s.
10. Osnovy nauchnyh issledovanii: Uchebnoe posobie /A.S. Kadyrov. — Karaganda: Sanat poligrafiya, 2020. -147 s
11. Osnovy nauchnyh issledovanii: ucheb. posobie / F.V. Grechnikov, V.R. Kargin. – Samara: İzd-vo SGAU, 2015. – 111 s.

The subjects of the disciplines "Technical operation of transport equipment", "Assessment and forecasting of reliability indicators of transport equipment", " Organization of scientific research "

according to the 2nd module

1. Determine the coefficient of technical readiness of the fleet with the following data of the enterprise: Number of vehicles in the fleet – 100 a/m; Average daily mileage - d_m =200 км; Average MTBF causing downtime - d_t= 0,5 th.km; Average specific downtime - d_t.=2,0 d/th.km; Total downtime of vehicles in maintenance and repair was as follows – 200 days.; downtime in CR – 15 days.; Time in the work - 8 hours.; Average operating speed – V_o= 25 km/h.
2. During 5 days 10 vehicle failures were eliminated in the repair area. At the same time, the total downtime was 35 hours. Due to the lack of spare parts, the downtime of vehicles was 5 hours. How is the recovery flow parameter determined and what will it be equal to?
3. The MTBF of petrol pumps follows a normal law (N=100 pc., L= 20 th.km, υ=0,2). How many petrol pumps will fail by 24 thousand km?

4. Classification of failures according to the pattern of occurrence.
5. Give a full description of constant road conditions.
6. The KamAZ car (which has a standard mileage of 300,000 km) had a mileage of 30,000 km for half a year. During this period, he stood in maintenance and TR at the enterprise for 18 days. The standard downtime in maintenance and repair for KamAZ vehicles is 0.5, and in overhaul 15. Exceeded (+) or not (-) the car downtime rate for the reporting period?
7. A KamAZ truck (having a standard mileage of 300,000 km) had a mileage of 30,000 km during half a year. During this period, it stayed in maintenance and repair at the enterprise for 18 days. The norm of downtime in maintenance and repair for ZIL cars is 0.5, and in overhaul repair 15. Is the vehicle idle rate for the reporting period exceeded (+) or not (-)?
8. What refers to the operation indicators of motorways.
9. What does the term "Diagnostic System" include?
10. The leading function of dump truck failure flow at the run L_1=10 thousand km was Ω=2.5; at run L_2=30 thousand kilometres Ω=4.0. How the failure flow parameter is determined and what is equal to at run L_2-L_1.
11. In the mileage interval L_1=10 thousand km - L_2=30 th. km the number of dump trucks N_i =20 units. The leading function of failure flow at the mileage L_1=10 thousand km Ω_1=3,0; at the mileage L_2 = 30 th. km Ω_2=5,0. How is determined and what will be equal to the total number of unit replacements for the planned mileage L_{plan}= 5 th. km.
12. During the reporting period the dump truck worked for 50 days. During the same period it was in maintenance - 5 days and 5 days in repair. How to determine and what is the availability factor K_a?
13. During the reporting period the dump truck worked for 50 days. During the same period it was in maintenance - 5 days and 5 days in repair. How is the technical utilisation factor K_{tu} determined and what will it be equal to?
14. How failures are categorised by source of occurrence.
15. Basic properties of fuels for petrol vehicles.
16. Assessment of the quality of work on the level and nature of failures on the mileage between maintenance.
17.Describe the types of failures and malfunctions of technical systems
18. Describe the types of friction depending on the thickness of the lubricant layer
19. Describe the types of friction by kinematic feature
20. Describe the process of wear of solids, giving general concepts and definitions
21. Describe the process of erosion wear and car parts subjected to this type of wear
22. Describe the process of hydrogen wear and the parts of a vehicle subjected to this type of wear
23. Describe the three stages of wear of a rubbing body.
24. Describe how adsorptive reduction in strength of rubbing bodies occurs.
25. Describe the influence of operator's subjective characteristics on the intensity of wear of machine elements and measures to reduce wear that depend on the subjective characteristics of the operator
26.Describe the process of seizure wear, list the parts of the vehicle that are susceptible to this type of wear and measures to protect parts from this type of wear
27. Describe the process of abrasive wear, list the parts of the vehicle that are subject to this type of wear and measures to protect parts from this type of wear
28. Describe the process of mechanical interaction between the working surfaces of parts
29. Describe the areas (nominal, actual, and contour) of contact between the work surfaces of the parts
30. General characterisation of plastic lubricants
31. Failure patterns of remanufactured parts
32. Self-repairing materials
33. Structural methods of reliability assurance
34. Technological methods of reliability assurance
35. Regression analysis
36. Methods of mathematical analysis. Mathematical models, general concepts
37. Economic and mathematical modeling, models, general concepts
38. Simulation modeling, models, general concepts

39. Elements of the analysis of variance
40. The finite element method
41. Design of measuring systems
42. Confidence interval, minimum number of measurements
43. The method of morphological analysis on the example of transport equipment
44. Network modeling. Functional and hierarchical modeling
45. Correlation analysis
46. Analytical research methods
47. Mathematical research methods
48. Adaptive smoothing method. The interview method. Example
49. Accidental and systematic error. Give examples. What are the ways to reduce errors?
50. The commission method. What are the rules for brainstorming

List of recommended literature:

1. Osnovy tehnicheskoi ekspluatatsii transportnoi tehniki / S.J. Kabikenov, T.S. İntykov, M.M. Kirievskii, V.V. Şalaev ; Karagandinskii gosudarstvennyi tehnicheskii universi- tet. -Karaganda.: İzdatelstvo KarGTU. 2015.-261 s.
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4. Optimizatsiya i upravlenie pri tehnicheskoi ekspluatatsii avtomobilei. / J.A. Aliev J.A., S.J.Kabikenov, M.M. Kirievskii : Uchebnoe posobie: - Karaganda: KarGTU, 2000. – 210 s.
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8. Ludchenko A.A., Ludchenko YA.A., Primak T.A. Osnovy nauchnyh issledovanii: Ucheb. posobie / Pod red. A.A. Ludchenko. — 2-e izd., ster. — K.: Ovo "Znaniya", KOO, 2001. — 113 s.
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The subjects of the disciplines "Technical operation of transport equipment", "Assessment and forecasting of reliability indicators of transport equipment", " Organization of scientific research "
according to the 3rd module

1. Give a structural and investigative model for diagnosing the gearbox
2. Give a functional model of the variable gearbox operation.
3. Give a structural and investigative model of diagnosing the power supply system of a high-pressure fuel pump
4. Give a functional model of the operation of a high-pressure fuel pump
5. Give a structural and investigative model for diagnosing the oil pump

6. Give a functional model of the operation of a oil pump
7. Give a structural and investigative model for diagnosing the brake cylinder
8. Give a functional model of the operation of a brake cylinder
9. Give a structural and investigative model for diagnosing the hydraulic booster.
10. Give a structural and investigative model for diagnosing the compressor
11. Give a structural and investigative model for diagnosing the a main gear
12. What are «traffic conitions» and what are like
13. The physical meaning of gamma percent failure time
14. Give a structural and investigative model for diagnosing an automatic transmission
15. Give an algorithm for diagnosing the front suspension of the car.
16. Give a structural and investigative model for diagnosing the generator
17. Factors affecting the reliability of internal combustion engines
18. Factors affecting the reliability of the variable gearbox
19. Factors affecting reliability of PTO transmission
20. Factors affecting the reliability of the vehicle clutch
21. Factors affecting the reliability of the braking system of the car
22. Describe the operating conditions of clutch friction clutches and measures to improve their performance
23. Describe the operating conditions of gear reducers and measures to improve their performance
24. Describe the operating conditions of braking devices and measures to improve their performance
25. Describe the operating conditions of control drives and measures to improve their performance.
26. Describe the operating conditions of the electrical equipment and measures to improve its performance
27. The role of man in machine reliability
28. Describe fatigue failure of metals, list vehicle parts that are susceptible to this type of failure and measures to protect parts from fatigue failure
29. Describe the mechanism of lubricating action of oils and the effect of tribopolymerisation
30. Describe the algorithm of change of properties of plastic lubricants in the process of operation
31. Describe chemical corrosion of metals, list the parts of a car that are susceptible to this type of corrosion and measures to protect parts from chemical corrosion
32. Describe electrochemical corrosion of metals, list the vehicle parts that are susceptible to this type of corrosion and measures to protect parts from electrochemical corrosion.
33. Registration of the results of scientific research
34. What is the planning of the experiment?
35. What is the basis for choosing a model when planning an experiment?
36. Metrology in experimental research
37. The main stages of experiment planning?
38. Probabilistic and statistical research methods
39. Criteria for evaluating the reliability of research results
40. What is the characteristic of a two-factor experiment
41. What is the characteristic of a three-factor experiment
42. List certain techniques and methods of intensification of thinking
43. How many levels of cognition are distinguished in the methodology of science? What characterizes the new paradigm?
44. Graphical and mathematical analysis of the experimental results
45. Application of application programs in research work
46. Hypothesis as one of the important elements in the methodology of scientific research. Methods of verification, confirmation and refutation of scientific hypotheses and theories
47. What should be understood by the systematization of research results? For what purposes is the approbation of the results of scientific work carried out?
48. Graphical methods used in research
49. What are the main patterns of measuring instruments that an experimenter should know. What systematic errors can there be?

50. What contradictions in science and practice are you aware of?

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1. Osnovy tehnicheskoi ekspluatatsii transportnoi tehniki / S.J. Kabikenov, T.S. İntykov, M.M. Kirievskii, V.V. Şalaev ; Karagandinskii gosudarstvennyi tehnicheskii universi- tet. -Karaganda.: İzdatelstvo KarGTU. 2015.-261 s.
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The approximate subject of the essay on the educational program 8D07102 – "Transport, transport equipment and technologies"

№	Essay topics (English)
1	**Advanced modes of transport**
2	**Intelligent vehicles**
3	**Alternative fuels for transport**
4	**Problems of increasing the capacity of transport infrastructure**
5	**Prospects for the development of special transport**
6	**Transition to the principle of public transport dominance**
7	**Reduction of traffic accidents**
8	**Promising development of transport tires**
9	**New energy sources for transport**
10	**Unmanned vehicles**

Head of the TE and LS Department **Kabikenov S.Zh.**

Approved at the meeting of the **TE and LS** Department
Protocol No. 17 dated 03 04 2024.