Projekt

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY

«KHARKIV POLYTECHNIC INSTITUTE»

METHODICAL INSTRUCTIONS

for independent work in the discipline « Basics of Operation and Maintenance of Vehicles at Service Stations »

for full-time and part-time students

in the speciality 274 «Road transport»

Approved by the Editorial

and Publishing Board of the University,

Minutes No. __ of __.__.2025

Kharkiv

NTU «KHPI»

2025

Methodical instructions for independent work in the discipline «Basics of operation and maintenance of vehicles at service stations» for full-time and part-time students majoring in 274 «Motor Transport» / compiled by Ahapov O. M. - Kharkiv: NTU «KhPI». – 2025. – 14 p.

Compiler: O. M. Ahapov

Reviewer E. S. Pelypenko

Department of Automotive and Tractor Engineering

1. GOAL AND OBJECTIVES OF INDEPENDENT WORK STUDENTS

The purpose of independent work of students in the study of disci-pline ‘Fundamentals of operation, maintenance of cars in service stations’ is to reinforce the knowledge gained by them during classroom classes, in the development of new knowledge on the basics of technical operation of motor transport and on the management of maintenance and repair of cars.

Independent work of students is the most important part of the process of training a specialist with higher education.

The main goals of independent work of students:

- formation of students' skills to independent creative labour;
- gaining experience in planning and organisation of working time;
- ability to solve complex professional tasks independently.

The curriculum of the discipline ‘Fundamentals of operation, maintenance of cars in service stations’ provides for full-time (full-time) students 86 hours of independent work.

The main types of independent work of students are as follows:

- working through the topics put on the independent work of students;
- working through lecture notes, textbooks and other educational and methodological literature;
- preparation for the control survey, exam.

Quality control of the development of the topics put on the self-dependent work is carried out by performing modular work on the given topics and interview when working in the classroom and taking the exam.

2. GENERAL RECOMMENDATIONS ON THE ORGANISATION OF STUDENTS' INDEPENDENT WORK

Hours of independent work of students, allocated in the working curriculum, is a type of classes, which each student organises and plans independently. It is necessary to pay attention to the list of recommended

literature. The student should ask for help in selecting literature in the bibliographic department of the library, reading room, which he visits, use the systematic and alphabetical catalogues and catalogue of new arrivals. It is also necessary to address to periodicals, site and repository NTU 'KHPI'.

The best assimilation of the read contributes to the maintenance of notes and card indexes of the read books. The most important concepts, definitions, own comments on the read material are written out in the outline.

For each topic there is a list of basic concepts that the student must learn and remember, as well as control questions for self-check.

Students who study the discipline independently, can always get counselling on difficult and problematic issues from the teacher of the discipline in the days and hours allocated for this purpose.

The schedule of consultations is on the website of the department.

3. **CONTENT OF TOPICS FOR INDEPENDENT WORK**

3.1 Diagnostic and adjustment works on the electrical system

- Diagnostics of accumulator batteries;
- generator diagnostics;
- diagnostics of starter, lighting and signalling devices;
- diagnostics of the ignition system and instrumentation.

Questions for self-checking

1. Basic faults of accumulator batteries.
2. How is the electrolyte for acid batteries prepared?
3. When the density of electrolyte decreases by 0.01 g/cm3, by how many per cent does the battery discharge?
4. What method can be used to check the condition of the battery when starting the engine (with a warmed battery and engine)?
5. What factors reduce the service life of the battery?

3.2 The main components of the technological process, types of work performed during maintenance and repair work

- the concept of technological process;
- difference between complex ATP and specialised ones;
- main types of works on maintenance and repair work-1, maintenance and repair work-2.

Questions for self-checking

1. What is meant by the technology of maintenance and repair work?
2. Give a definition of the concept of operation as part of the technological process. What is called a transition?
3. What is the difference between work TO-1 and TO-2?
4. Give a definition of the production process of motor transport-port enterprises.

3.3 Ways to save fuel and lubricants. Peculiarities of operation of the gas-ballon system of a car during maintenance and repair work

- the share of fuel in the total cost of carriage by motor transport;
- variants of occurrence of losses of fuel and lubricants during storage and transport;
- peculiarities of daily maintenance of gas-zoballon systems of automobiles;
- the basic principles of determining the route of the car during maintenance and repair work.

Questions for self-checking

1. What are the main differences in the transportation, storage and distribution of diesel fuel compared to gasoline?
2. What measures are necessary for economical fuel consumption?
3. What should be taken into account when reducing quantitative and qualitative losses?
4. What routine maintenance work is included in the list for seasonal maintenance of gas cylinder systems of vehicles?
5. What is the peculiarity of post work on the gas cylinder system?
6. Where should the maintenance and repair posts of vehicles with a gas cylinder system be located?

3.4. Features of technical operation of vehicles operating away from permanent bases

- the concept of short-term deployment and operation of rolling stock away from the production and technical base (PTB);
- the main factors influencing the organization of technical operation of vehicles in agricultural transportation;
- the choice of models of the vehicle fleet performing work away from the PTB.

Questions for self-checking

1. What conditions predetermine the creation of motor towns?
2. What percentage of trucks from the total fleet of Ukraine participate annually in agricultural transportation?
3. What is the intensity of vehicle operation outside of the PTB?
4. What task does departmental transport perform (geological exploration, laying power transmission and communication lines)?

3.5. The impact of motor transport on the environment

- Motorization and its consequences;
- increasing fuel efficiency and environmental friendliness of the car by design measures;
- neutralization of exhaust gases (EG).

As a result of studying the topic, the student should understand what possible ways and means exist to reduce the harmful impact of motor transport on the environment.

Questions for self-checking

1. What is the share of motor transport in the total freight turnover of the country?
2. What are the ways to improve the processes of mixture formation and combustion in gasoline engines?
3. How many ways are there to neutralize exhaust gases?
4. What are the main components of the exhaust gases of internal combustion engines?

3.6. Alternative types of fuel, prospects for their use in motor transport

One of the ways to save liquid petroleum fuel and reduce the level of environmental pollution is the replacement (complete or partial) of gasoline and diesel fuels with other energy sources of non-petroleum origin:

- liquefied petroleum gases;
- compressed natural gas;
- synthetic alcohols;
- gas condensates;
- hydrogen;
- vegetable fuels.

Questions for self-checking

1. At what excess pressure does petroleum gas change from a gaseous state to a liquid phase?
2. What components does liquefied gas used as motor fuel consist of?
3. What are the advantages and disadvantages of using synthetic alcohols as motor fuel?
4. What are the disadvantages of vegetable fuels when used as motor fuel?

3.7. Flaw detection as a method for determining the quality of spare parts repair. Fundamentals of the flaw detection method

- The main types of defects that occur at the stage of manufacturing and operation of vehicle unit components;
- methods used to detect defects in housing or other parts of engines, units.

When mastering this topic, the student must study the existing methods that are used for defect detection of products during the manufacture, operation and repair of cars.

Questions for self-checking

1. Describe the simplest methods for detecting cracks in parts of units.
2. How does the material from which the part is made affect the choice of flaw detection method?
3. What principle is the X-ray flaw detection method based on?

4. What is the advantage of the xerographic method?

3.8. Organization of repair bases in isolation from the main complex

- Requirements for the content of the volume of maintenance;
- basic methods of car repair;
- selection of technological equipment;
- storage of technical property, units and spare parts.

Questions for self-checking

1. What means are used to eliminate vehicle failures and malfunctions depending on the degree of complexity?
2. What are the features of the unit-unit repair method?
3. Describe the most rational schedule for carrying out maintenance 1, maintenance 2 for vehicles involved in agricultural transportation.
4. What are the features of storing lubricants and paints and varnishes, acids, brake fluid?

Test questions for students' modular work

1. What density of electrolyte is added to the battery when the overall density decreases?
2. What should be done if the difference in density in individual banks of the battery is more than 0.01 g/cm3?
3. What should be the level of regulated voltage of the vehicle's on-board network?
4. In what modes and what parameters is the starter removed from the engine checked?
5. By what parameters are the headlights of the vehicle adjusted?
6. What work is included in the concept of control, diagnostic and adjustment work?
7. Why is it necessary to carry out fastening work?
8. The main task of the TR of vehicles?

9. What is the largest amount of fuel spent on when the vehicle is moving at different speeds?

10. What are the aims of fuel saving measures during storage?

11. What units should be given primary attention when checking the fuel system of gas-powered vehicles?

12. What technological equipment should be installed in a mobile workshop?

13. What vehicles are used to transport liquid fuel?

14. What documents should be completed when dispensing, transporting and receiving liquid fuel?

15. Explain the need to determine the temperature of liquid fuel received at an oil depot, ATP?

16. Under what conditions does an explosive situation arise in the fuel storage area?

17. What protection methods are used to prevent liquid fuel from igniting during storage?

18. How does a "flame fuse" work?

19. What basic parameters should a fuel dispenser meet?

20. At what pressure can liquefied gas be stored and transported?

21. What is the composition of liquefied gas.

22. What substances are added to liquefied gas at particularly low temperatures and in what proportion?

23. What is the boiling point of propane, butane and their mixtures?

24. At what pressure is compressed gas pumped and into which cylinders?

25. Where do cars fill up with compressed gas and at what pressure?

26. What are the purposes of automobile gas filling complexes and stations?

27. How is the required amount of gas calculated when filling cylinders on a car?

28. In what microclimatic regions is the territory of Ukraine located and what is its area?

29. What methods are used to improve the efficiency of technical operation of cars?

30. Name the features that distinguish a car in the northern version from cars of the standard version.

31. What changes have been made to the design of cars used in high-mountainous areas?

32. Name the factors that worsen the starting characteristics of internal combustion engines?

33. Give a definition of the concept of "garageless storage of cars".

34. What means are used during garageless storage to facilitate the release of the car on the road?

35. What is the difference between the methods of heating and warming up car engines?

36. What conditions must be met for a reliable start of a car engine?

37. What should be the total starter torque Mc to achieve the minimum starting speed of the crankshaft of an internal combustion engine?

38. By what percentage does the capacity of a battery decrease with a temperature drop of 1 °C?

39. At what temperature of the electrolyte does the battery not accept charging current?

40. By how many degrees should the temperature of the end of the compression stroke Tc be higher than the autoignition temperature of the working mixture for a reliable start of the engine?

41. How many times does the viscosity of diesel fuel increase with a temperature drop from +20 °C to -20 °C?

42. Name the methods for overcoming difficulties with starting the engine when storing it outside a garage.

43. What means are used when storing cars outside a garage?

44. What substances are used for cold starting the engine?

45. What conditions determine the need to organize traffic towns?

46. Name the main requirements that must be met when organizing traffic towns?

47. How does the organization of maintenance and repair production depend on the size of the motorcade?

48. What elements must be taken into account when organizing a motorcade, for example, for 30 cars and 15 trailers?

49. What should be the service life of the main units for intercity and international transportation?

50. What should the project for organizing work for intercity and international transportation provide for?

51. How does a car have a harmful effect on the environment?

52. What substances are included in the composition of exhaust gases?

53. What is the maximum noise level at which a person can work for 8 hours, and at what level can there be an injury?

54. How many liters of oxygen are needed to burn 1 kg of gasoline?

55. What percentage of oxygen is contained in the composition of the air in the environment and what consequences can there be for human health when the oxygen content in the air decreases?

56. Describe the operating principles of a combined power plant used in a car.

57. What methods are used to monitor the operation of gasoline and diesel engines?

58. In addition to exhaust gases, what waste from car operation poses an environmental hazard?

59. How many ways are there to dispose of lead batteries?

60. How many ways are there to dispose of worn-out tires?

61. How many groups are used oils divided into when collected?

62. Name the possible options for reusing used petroleum products.

List Of Information Sources

1. Ludchenko O.A. Technical operation and repair of cars: Textbook. - K.: Znannya-Press, 2003. -511 p.

2. Ludchenko O.A. Technical operation and maintenance of cars: Technology: Textbook. -K.: Higher School, 2007. -527 p.

3. Ludchenko O.A. Technical operation and repair of cars: organisation and management: Textbook. - K.: Znannya, 2004. – 478 p.

4. Fornalchyk E.Y., Oliskevych M.S., Mastikash O.L., Pello R.A. Technical operation and reliability of cars: Textbook / Under the general editorship of E.Y. Fornalchyk - Lviv: Afisha, 2004. - 492 p.

5. Workshop on the theory of technical operation of machines: a textbook / O.I. Subochev, O.D. Derkach, I.F. Ostrov; Dnipro State Agrarian and Economic University: Lithograph Publishing House, 2017. 130 p.

6. Bilichenko V.V., Varchuk V.V., Vdovychenko O.V. Management of technical services at motor transport enterprises. Study guide. Vinnytsia: VNTU, 2006 - 117 p.

7. DSTU 3649: 2010 Wheeled vehicles. Requirements for safety of technical condition and methods of control

8. DSTU 2886-94 Motor vehicles. Braking properties. Terms and definitions

9. DSTU 2919-94 Motor vehicles. Brake systems. Terms and definitions

10. DSTU 2984-95 Road vehicles. Types. Terms and definitions

11. DSTU 3333-96 Roller benches for testing the brake systems of road vehicles in operation. General technical requirements

Content

Educational publication

METHODICAL INSTRUCTIONS

for independent work in the discipline « Basics of Operation and Maintenance of Vehicles at Service Stations »

for full-time and part-time students

in the speciality 274 «Road transport»

Compiler:

AHAPOV Oleh Mykolaiovych

Responsible for publication prof. Rebrov A.Y.

Recommended for publication

In the author's edition

Plan for 2025, position

Signature for printing Headset Times New Roman

Publishing Center of NTU “KhPI”,

Kirpichova 2 Street, Kharkiv, 61002

Certificate of state registration DK No. 5478 dated August 21, 2017.

Electronic publication