and subways", 1–36 11 01 "Lifting and transport, construction, road machines and equipment", 1–70 03 01 "Automobile roads", 1–56 02 01 "Geodesy" / A. K. Esman, N. P. Yurkevich, H. K. Sauchuk, A. P. Akhmedov, S. B. Khudoyberganov, R. M. Mirsaatov; Belarusian National Technical University, Physics Department; Tashkent Institute for the design, construction and operation of roads. – Minsk: BNTU, 2020.

10. Coorsera. – Lucsera Inc, 2021. – Access mode: https://www.coursera.org. – Date of access: 18.12.2021.

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The use of solar panels to power the air conditioning and ventilation system of vans

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The automobile air conditioning system does not use electricity, but part of the power of the internal combustion engine, taken from its crankshaft by means of the drive belt. It is proposed to install portable mobile solar air conditioners in vans, which are powered from solar panels. The solar panels, on the other hand, are placed on the roof of the minibus. This ultimately leads to a significant reduction in material costs of hydrocarbons.

Car air conditioning system is a type of air conditioning system installed in the car and allows you to cool the air in the cabin, as well as to clean it from moisture and foreign odors. In modern cars, it is an integral part of the ventilation and heating system in the cabin. The peculiarity of such an air conditioner from a technical point of view is that it does not use electricity, but part of the power of the internal combustion engine, taken from its crankshaft by means of a drive belt, sometimes common with the generator belt or a separate one. The air conditioner condenser is usually located under the hood, and in order to avoid the influence of the engine heat on it, it is placed closer to the front bumper of the car, in front of the radiator, but in such a way that the air-cooling of the radiator does not suffer. Drainage of water from the air conditioner evaporator is carried out directly under the car, therefore it is often possible to see a puddle under the car with a working conditioner. Modern air conditioning units are usually structurally combined with the cabin heating system, using common air ducts and control system. Controls of heating and air conditioning systems in

modern cars are usually located on the dashboard, or on the center console between the driver and front passenger. Car air conditioner operates by the same principle as a usual domestic air conditioner or refrigerator, the only difference is a greater compactness of all units and the fact that the power source is an internal combustion engine (electric motor on electric cars). Air conditioner cools air due to the change of aggregation state of the working substance of the system − refrigerant. When changing from one aggregate state to another, the refrigerant takes in or gives out heat. In the air conditioning system circuit, the refrigerant changes from gaseous to liquid state in the condenser, then passes through the filter-drier and in the evaporator it changes again to gaseous state [1]. An air conditioner is based on a compressor and several other elements that require a power source, then an autonomous air conditioner is an air conditioner whose operation is independent of centralized external power sources. The air conditioner itself and the power source can be located in the same case or in different cases and have an electric cable connection. Car air conditioning system can also be called autonomous, as in each car at its core is a conventional refrigerating machine, and electric power is produced from a generator at the expense of the internal engine operation [2].

The latest portable mobile solar air conditioners are created and manufactured in China. Fig. 1. shows a portable mobile solar air conditioner that can be mounted on a car.

Fig. 1. Portable mobile solar air conditioner

Features:

1. 100% solar power source.
2. High quality and high efficiency DC compressor (refrigerant: R134a).
3. Quiet and modern design.
4. Remote control [3].

Since the input power of the portable mobile solar air conditioner is 533 W, it is necessary to install two solar panels of 270 W on the roof of the passenger car. This results in savings of up to 20 % of fuel (gasoline) when driving a passenger car.

Passenger vans occupy a special place in the transportation of people in the city and in the countryside. GAZ-32213 is the most capacious passenger minibus of GAZelle family, on the base of which the special version of "route cab" (Fig. 2) was made.

Notable for its reliable design and unpretentious maintenance, GAZ-32213 rather quickly gained popularity among commercial carriers and became the most common vehicle of its class on the roads of the CIS.

Fig. 2. GAZ-32213 - the most capacious passenger minibus

The GAZ-32213 is based on a van GAZ-2705 and minivan GAZ-3221, which is clearly reminded by the contours of the minibus body. GAZ-32213 cabin is divided into cab and passenger compartment with a low partition. The cabin provides two passenger seats excluding the driver, and in the back of the body there are 11 comfortable high-back and upholstered chairs [4].

GAZelle-NEXT modification A63R42 is a modern and comfortable minibus (by the number of seats) designed for suburban and intercity passenger transportation, created on the basis of GAZelle-NEXT chassis (Fig.3).

GAZ-A63R42 passenger bus received a whole bunch of technological innovations, which were not practically used in domestic automobile industry before. Such approach allowed GAZ Group to produce a workable bus distinguished against the competitors by affordable price, ease of maintenance and durability of operation in different climatic conditions [4, 5].

Fig. 3. "GAZelle-NEXT modification A63R42

Fig. 4. Microbus with solar panels

For air conditioning in the cabin of the minibus, it is necessary to install four portable mobile solar air conditioners with a total capacity of 2100 watts. Eight solar panels with a capacity of 270 W each shall be installed on the roof of the minibus.

Fig. 5. Exhaust air fan for minibus

Solar panels can also be used to power the exhaust air fan in vans.

The use of solar panels for air conditioning and ventilation in the cabin of a minibus leads to a significant reduction in material costs of hydrocarbons.

References

1. Akhmedov, A. P. Innovative public transport stop with autonomous power supply / A. P. P. Akhmedov, S. B. Khudoyberganov, N. P. Yurkevich // Innovative technologies in water, municipal services and water transport: Proceedings of the Republican Scientific and Technical Conference, Minsk, 20−21 May 2021. − Minsk: Belarusian National Technical University, 2021. − P. 181−184.

2. Akhmedov, A. P. Methodology of combining real and virtual laboratory works in the educational process of students / A. P. Akhmedov, S. B. Khudoyberganov, Zh. Ochilov // Exact science. − 2019. − № 40. − С. 27−31.

3. Autonomous air conditioners // Dantex [electronic resource]. − 2005−2022. − Access mode: https://dantex.ru/articles/avtonomnye− konditsionery/. − Date of access: 10.11.2021.

4. Gazel minibus (GAZ−32213) // Commercial transport and machinery on IronHorse.RU [electronic resource]. − 2022. − Access mode: http://truck.ironhorse.ru/gazel-32213.html. − Date of access: 15.01.2022.

5. Gazel − Next suburban minibus // Commercial transport and machinery on IronHorse.RU [electronic resource]. − 2022. − Access mode: http://truck.ironhorse.ru/gazelle-next-bus.html. − Date of access: 15.01.2022.

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Из опыта организации научно-исследовательской работы студентов

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В условиях современного развития науки и техники особое внимание обращено не только на накопление определенной суммы знаний, но и на воспитание у студентов творческого подхода к изучаемым дисциплинам, к развитию исследовательских навыков. Привитие таких навыков возможно при условии широкого приобщения студентов в процессе обучения к научно-исследовательской работе (НИР).

Одной из форм приобщения студентов к научным исследованиям является проведение НИР со студентами первого и второго курсов на основе индивидуальных заданий с учетом способностей студентов.

Одна из тем, к выполнению которой привлекаются студенты первых и вторых курсов звучит так: «Исследование взаимодействия постоянных магнитов и электромагнитов с магнитными материалами типа стали и их