

INTEGRATED TRAINING COMPLEX «ENGINES OF INTERNAL COMBUSTION» IN SYSTEMS OF ENGINEERING EDUCATION

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Abstract *¾ Stated are the methodical bases of the organization of the preparation of engine engineers that is currently under development in the department of "Heat engineering and Tractor-automobile engines" in MSARCI (MADI). The concept of the course takes present-day requirements into account and is based on the use of modern information technologies. Practical realization of the strategy is illustrated by the example of an integrated training complex "Engines of internal combustion".*

Index Terms *¾ Integrated training complex, engines of internal combustion, automatic designing, process modelling.*

THE PROBLEM OF ENGINEERING EDUCATION

For the operation and development of the Russian automobile & transport complex (ATC), engineers-mechanics are constantly required, a great part of whom is prepared by MSARCI (MADI). They provide creation and work of all of its components: roads, transport facilities, organize the transport process. The required level of the heat-engineering preparation provides efficient work of ÀOC in the use the energy resources and in the solution of ecological problems.

Heat-engineering preparation of engineers-mechanics always includes the following three sections: thermodynamics, heat & mass exchange, special technical preparation. The correlation of volumes and levels of the comprehension of each of the parts is defined by problems, being solved by engineers of different specializations. There've always been such questions as "What to teach?" and "How to teach?". They're still actual for heat engineering.

THE INTEGRATED TRAINING COMPLEX – THE SOLUTION

Engineers-mechanics specializing on engines of internal combustion provide design, creation, exploration and exploitation of heat machines. Therefore their heat engineering preparation is one of the basic parts of their education. In these cases deep knowledge of the classical parts of heat engineering (including thermodynamics and

mass-exchange) is required. Future professionals in the field of engines must understand both ecological problems, connected with the engines' exploitation, and the construction and theory of working processes well.

The analysis of today's ecological situation requires us to complete the theory of internal combustion engines (ICE/EIC) with chapters, connected with the work of an engine as a part of a vehicle. We should also consider problems of the work of many ICEs in a transport stream. These new theoretical parts should be taken into account in the educational process. It is vital during the complex solution of actual problems of decrease of ecological charge of vehicles (toxicity and noise) on the environment. Understanding of many aspects of the ecological problem from the point of view of heat engineering is important for both road designers and engineers who organize the traffic.

High modern requirements for the level of students' preparation demand modernization of the forms of education. It is necessary to use technical means more actively in the modern educational cycle, the ones, which allow us to save students' and teachers' time and also the money, which is spent on the organization of the educational process. It is very important that technical means let us increase the quality of the educational process and provide the switch-over from the frontal educational method to the individual one.

Traditionally the department "Heat engineering and tractor-automobile engines" of MSARCI (MADI) students are educated with heat-engineering and special disciplines, connected with internal combustion engines. According to this circumstance, the department is developing two appropriate educational complexes. They are created with one general methodical basis. A complex text-book called "Internal combustion engines" can serve an illustration of the developed methodical basis. The text-book consists of three books and some software [1, 2, 3].

The training complex consists of a lecture course, laboratory practical works and a control system. All the training complex elements are interconnected and form a united system providing theoretical, experimental and accounting-analytical components in the process of future engineers education. The purpose of the lecture course is to present the students base theoretical material on the main sections of a discipline. The laboratory practical works are

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an active form of education. They help to achieve new knowledge through concrete experimental activity. It is very important that they allow combining individual and collective activity. A row of tasks can be formulated in the manner of a business play. The control system provides control of the knowledge level. It is universal for different courses.

The main purpose of the complex is to make the process of the course study active and demonstrative, to increase the students' interest for the subject being studied. Engines of internal combustion are a difficult technical system. The created lecture course demonstrates the connection between different parts of the EICs and between different physical processes. The lecture course lets us describe a wide range of possible technical solutions and analyse their pros and cons.

Computer lectures include many illustrations: flat and 3D pictures, diagrams, graphics of different dependencies, various models, structural schemes of objects and processes, etc.

The use of the complex of computer practical works on EICs' theory and construction lets us change the nature of the works being accomplished and offer the students individual tasks. Such an example teaches students to perform independent studies and to solve problems on their own.

One of the important parts of the educational complex is the system of automatic design of EICs. It uses parametrical models to describe a wide range of possible technical solutions. The presence of an original system of graphical support is one of the main features of the system of automatic design. It allows us to consider many variants of potential solutions, which is very important in the educational process. Minimum time expenses are required to learn to use this system.

The complex text-book includes materials for calculated modelling of processes, which occur in the EICs. The calculated modeling is organized on a uniform methodical basis and possesses a unified interface. Scientific research works have served a base for the development of the complex of calculated modeling. Theoretical models and methods of EICs' calculation are used by students to solve concrete practical problems.

For the first time in Russia packages of programs for the research of EICs' influence upon exploitation properties of a vehicle have been developed for students. They allow us to take the ecological and economic effect into account.

The complex textbook "EICs" provides current and permanent economic, as well as social effects and allows:

- to raise the quality of preparation on EICs and provide the level, corresponding to state educational standards, not depending on where the high school is located, on how much money it has and on their staffs' potential abilities
- to reduce expenses on students' teaching because the complex text-book brings the main functions of remote

education to life, which is especially important for Russia's far-away regions

- to widen the range of educational services' consumers
- to reduce expenses on the creation and servicing of a complex laboratory of a high school and on the carrying out of an experiment. It removes time restrictions on the experiments' performance and provides the possibility of the carrying out of extreme experiments
- to provide the opportunity to formalize the leading teachers' experience, which reduces expenses for young teachers' preparation

CONCLUSION

The use the complex textbook "EICs" lets us reduce the damage, dealt to the environment from the carrying out of real-life experiments while testing engines. It provides the modern level of the ecological preparation of the engineering personnel.

The fragments of the created integrated training complex can be used for teaching at different engineering courses. It is highly appreciated by teachers, because it makes their mutual work with students more creative.

The created integrated training complex is executed in the manner of electronic textbook. At present it is used in the scholastic process in technical universities not only in Russia, but also in other countries.

As a result of the creation the complex textbook "EICs" a new methodical basis of the use of information technologies in engineering education has been designed. The textbook has been awarded the Russia's government prize in the field of science and technology in 1999.

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