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OSVRT NA IZOBRAZBU INŽENJERA IZ PODRUČJA MOTORA I VOZILA NA FAKULTETU STROJARSTVA I BRODOGRADNJE SVEUČILIŠTA U ZAGREBU

SAŽETAK

U radu je dan pregled značenja automobila u prometnom i gospodarskom sustavu Hrvatske, s osvrtom u odnosu na razvijene zemlje. U nastavku je prikazana visokoškolska nastava iz područja motora i vozila na Fakultetu strojarstva i brodogradnje Sveučilišta u Zagrebu, počev od osnutka Visoke tehničke škole 1919. godine do danas. Prezentirani su kolegiji koji se odnose na dodiplomski i postdiplomski studij. Prikazan je statistički pregled broja kandidata koji su diplomirali, magistrirali i doktorirali na području transportnih sredstava.

1. UVOD

Sada, na pragu rastanka s dvadesetim stoljećem, bez dvoumljenja se može reći da je gospodarski i svaki drugi razvoj u tom razdoblju bio obilježen snažnim unapređenjem proizvodnje automobila i radnih strojeva pogonjenih motorima s unutarnjim izgaranjem, kao što su traktori, šumarski i građevinski strojevi i slično. Razvoj motorne industrije zahtijevao je i omogućio razvoj mnogih drugih industrijskih i gospodarskih grana (proizvodnja i preradba nafte, industrija čelika, aluminija, plastičnih materijala, gume, stakla, boja, lakova i slično). Iako su naftne krize 70-ih godina bile pravi "šok" za automobil i njegovo korištenje, to vozilo pokazalo je začuđujuću izdržljivost. Zanimanje za automobil, nakon izvjesnog zastoja u tim godinama, ne samo da nije trajno smanjeno, već je i povećano. Zahvaljujući svojim usporedbenim prednostima, automobil zadržava vodeću ulogu u obavljanju određenih transportnih funkcija. To izravno pokazuju podaci o proizvodnji osobnih automobila u svijetu (sl. 1.). Razlozi za takvu žilavost automobilske prometa, čak i uza sve probleme koje taj oblik transporta uzrokuje, vrlo su složeni. Međutim, izgleda da tu vrlo značajnu ulogu ima iskonska osobina čovjeka da cijeni vlastitu individualnost. Kada je riječ o transportu, sigurno je da automobil po tom kriteriju nema konkurencije. Također, automobil je jedino transportno sredstvo pomoću kojega se transportna usluga može obavljati "od praga do praga", a to mu je vrlo značajna prednost.

U posljednje vrijeme u svijetu se proizvodi više od 40 milijuna motornih vozila na godinu. Trenutačno je na svim cestama svijeta u prometu više od 400 milijuna automobila. Smatra se da, u industrijski razvijenim zemljama, u automobilske industrije radi oko 15% od svih zaposlenih djelatnika. U djelatnostima koje

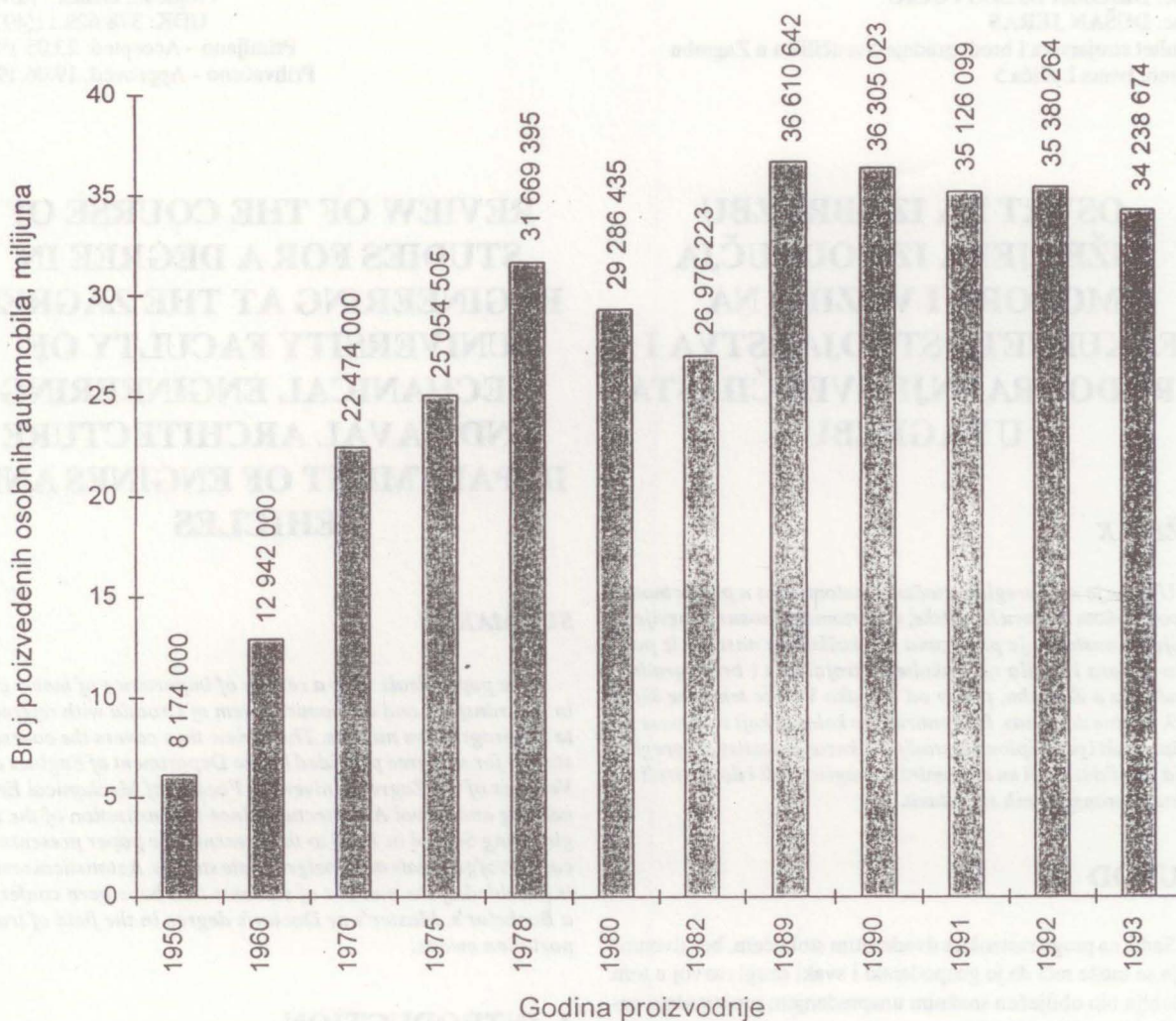
REVIEW OF THE COURSE OF STUDIES FOR A DEGREE IN ENGINEERING AT THE ZAGREB UNIVERSITY FACULTY OF MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE DEPARTMENT OF ENGINES AND VEHICLES

SUMMARY

The paper deals with a review of importance of motor cars in the transport and economic system of Croatia with reference to the progressive nations. The review then covers the course of studies for a degree provided by the Department of Engines and Vehicles of the Zagreb University Faculty of Mechanical Engineering and Naval Architecture since the institution of the Engineering School in 1919 to the present. The paper presents the courses of graduate and postgraduate studies. A statistical review is provided of the number of students that have been conferred a Bachelor's, Master's or Doctor's degree in the field of transportation means.

1. INTRODUCTION

Today at the turn of the century we can state without hesitation that the economic and all other progress in this century has been marked by a vigorous growth of the automobile industry and machines powered by internal combustion engines, as farm tractors, forest and construction machinery, etc. The development of motor industry has called for and enabled the development of numerous other industrial and economic segments (manufacturing/processing of oil, steel, aluminium, plastic materials, rubber, glass, paint, varnish, etc.). Although the instances of petroleum crisis back in the seventies caused major "shock" for automobile and its utilization, the motor vehicle has exhibited surprising sturdiness. Interest in automobiles has not after certain stagnation in the years of fuel crisis enervated on a more permanent scale but has in contrast been reinforced. Owing to its comparative advantages, the automobile keeps the lead in the completion of some specific transportation functions. The reports on the number of automobiles leaving the assembly lines in the world clearly show the upward trend (Figure 1). Complex is the background of such power of endurance of motor traffic notwithstanding all possible problems originating from this transport aspect. However, it appears that a major role is to be ascribed to the centuries-old man's quality to value his own individuality. As far as transport is concerned, beyond any doubt the automobile has no competition judging by this criterion. Furthermore, the automobile is the only



Slika 1. Proizvodnja osobnih automobila u svijetu
Figure 1. Production of Automobiles in the World

su vezane na proizvodnju naftinih preradevina, gradnju i održavanje cesta, regulaciju i kontrolu prometa i slično radi još oko 25% od svih zaposlenih. Ti podaci daju jasnu kvantitativnu sliku o značenju motorizacije za gospodarstvo tih zemalja i čitavog svijeta.

Na Fakultetu nas posebno zanima činjenica da je razvoj automobila znatno utjecao na znanstvenoistraživački rad i da je dao svoj pečat na razvoj tehničkih znanosti u cjelini. Isto tako, razvoj automobilske tehnike ostavio je traga i na nastavnom procesu izobrazbe tehničkih, posebno strojarških kadrova. Stoga mislimo da je ovom prilikom zanimljivo osvrnuti se na nastavno djelovanje u području motora i vozila na Fakultetu strojarstva i brodogradnje Sveučilišta u Zagrebu, počev od njegova osnivanja pa do danas.

2. PREGLED NASTAVE NA FAKULTETU STROJARSTVA I BRODOGRADNJE IZ PODRUČJA MOTORA I VOZILA

Visokoškolska nastava iz područja tehničkih znanosti na Sveučilištu u Zagrebu započela je osnivanjem Visoke tehničke škole 1919. godine. Već u prvom nastavnom planu za sve studente

conveyance involving a transport service "from door to door", being its major advantage.

In recent times over 40 million motor vehicles are manufactured in the world annually. Currently, over 400 million cars are travelling the roads of the world. It is estimated that in progressive nations some 15% of the total working population hold jobs in the automobile industry. In the industries dealing with petroleum products, construction and maintenance of roads, management and control of traffic, etc., some 25% of the total working population earn their living. The above data gives a clear quantitative picture on the import of motorization for the economies of these nations and the whole world.

At our faculty we show a particular interest in the fact that the development of automobiles has had a major impact upon research and has left its mark in the advancement of engineering science as a whole. Furthermore, the development of automotive engineering has also marked the process of education and training of would-be engineers, in particular of mechanical engineers. Consequently we believe it may be of interest to review the teaching assignment in the field of engines and vehicles at the Zagreb University Faculty of Mechanical Engineering and Naval Architecture, since its institution to the present.

bio je predviđen kolegij "Eksplozivni motori", s 4 sata predavanja i 4 sata vježbi, a osnivač kolegija bio je prof. Josip Miler. Godine 1941., na tada Tehnički fakultet, dolazi prof. Dragutin Krpan. On uočava trend u razvoju prometnih sredstava, posebice cestovnih vozila i njihovih pogonskih motora, te pri Strojarskom odjelu Tehničkog fakulteta osniva Laboratorij za motorizaciju i uvodi predmet "Gradnja i tehnologija brzohodnih motora". Već 1950. godine osnovan je Zavod za lake motore i motorna vozila i uvedeni su predmeti "Laki motori", "Motorna vozila" i "Propulzioni motori". Te predmete pratile su opsežne laboratorijske i konstrukcijske vježbe. Sadržaj predmeta "Laki motori" obuhvaćao je automobilske motore, traktorske motore, motore građevinskih strojeva, lokomotivske i stapne zrakoplovne motore. U posebnom predmetu pod nazivom "Eksplozivni motori", a, kasnije, nakon dolaska prof. Miroslava Mikuličića, pod nazivom "Motori s unutrašnjim izgaranjem", obrađivala se teorija motora i konstrukcija sporohodnih motora, brodskih i stacionarnih. Godine 1956. osnovan je samostalni Strojarsko-brodograđevni fakultet s odjelima strojograđevnim, usmjerenja konstrukcijsko i tehnološko, i brodograđevnim, usmjerenja brodograđevno i brodstrojarsko. Nastava iz područja lakih motora i motornih vozila izvodi se u okviru strojograđevnog odjela, konstrukcijskog usmjerenja.

U školskoj godini 1967./68. počinje djelovati Fakultet strojarstva i brodogradnje Sveučilišta u Zagrebu, koji je nastao integracijom Strojarsko-brodograđevnog fakulteta Sveučilišta u Zagrebu i Visoke tehničke škole Sveučilišta u Zagrebu. Na Fakultetu se formiraju tri odjela: strojarsko-konstruktorski, strojarsko-proizvodni i brodograđevni, a u strojarsko-konstruktorskom odjelu osniva se usmjerenje "Motori i vozila". Godine 1978./79. donesen je modificirani nastavni plan, a usmjerenje dobiva naziv "Motori, vozila i transport u industriji". Za ovo usmjerenje svojstveni predmeti bili su "Voda, gorivo i maziva" 2+1, "Laki motori" 4+2, "Propulzivni motori 2+0", "Lokomotive" 4+2, "Motorna vozila" 4+2, "Transport u industriji" 4+2, "Laki motori - laboratorijske vježbe" 0+4, "Motorna vozila - laboratorijske vježbe" 0+4, "Konstrukcijske vježbe" 0+4, "Uvod u diplomski rad (konstrukcijske vježbe)" 0+4.

Školske godine 1981./82. počeo se primjenjivati reformirani nastavni plan koji u završnom dijelu studija strojarstva ima tri smjera: "Proizvodno strojarstvo", "Strojarske konstrukcije" i "Procesno-energetski smjer", a nastava iz područja motora i vozila u okviru nastavne discipline "Transportna sredstva" provodi se u smjeru "Strojarske konstrukcije". Podjela po smjerovima počinje od 5. semestra. Predmeti iz nastavne discipline "Transportna sredstva" su:

- "Prenosila i dizala"	VI/4+2
- "Prenosila i dizala, semestralni rad"	VI/0+4
- "Lokomotive"	VII/4+2*
- "Sredstva unutrašnjeg transporta"	VII/4+2*
- "Goriva i maziva"	VII/2+1*
- "Motori"	VIII/6+2
- "Motorna vozila"	VIII/4+2
- "Motori i motorna vozila, praktikum"	VIII/0+6
- "Motori i motorna vozila, semestralni rad"	VIII/0+4
- "Dinamika vozila"	VIII/2+1*
- "Ispitivanje motornih vozila"	VIII/2+1*.

sa * su označeni izborni predmeti.

Od školske godine 1994./95. nastava u smjeru "Strojarske konstrukcije" proširuje se nastavnim skupinama koje su od interesa za potrebe Hrvatske vojske. Te skupine su "Vojna motorna

2. REVIEW OF COURSES AT THE FACULTY OF MECHANICAL ENGINEERING AND NAVAL ARCHITECTURE DEPARTMENT OF ENGINES AND VEHICLES

University courses in the field of engineering science at the University of Zagreb initiated with the institution of the College of Engineering back in 1919. The first curriculum designed for all students included the course Internal Combustion Engines, with four hours of lectures and four hours of demonstrations, while the originator of the course was Professor Josip Miler. In 1941 Professor Dragutin Krpan joined the teaching staff at the College of Engineering. He was cognizant of the existing trend in the development of transportation means in particular of motor vehicles and their engines and set up the Laboratory for motor vehicles with the Department of Mechanical Engineering of the College of Engineering and introduced the course Construction and Technology of High-Speed Engines.

As early the year 1950 the Institute for Light Engines and Motor Vehicles was founded followed by the introduction of courses Light Engines, Motor Vehicles and Propulsion Engines. These courses were supported by comprehensive laboratory and structural demonstrations. The course Light Engines dealt with car engines, farm tractor engines, engines of construction machines, locomotives and aircraft piston engines. A special course Internal Combustion Engines, given this name at the time of Professor Miroslav Mikuličić's joining the teaching staff, dealt with the theory of engines and structure of low-speed engines, marine and stationary applications. In the year 1956 the Faculty of Mechanical Engineering and Naval Architecture in its own right was instituted, with the Department of Engineering, providing training in the line of construction and technology, and the Department of Shipbuilding, providing training in the line of shipbuilding and marine engines. Training in the field of light engines and motor vehicles was provided at the Department of Engineering, line of structural design.

In the academic year 1967/1968 the Zagreb University Faculty of Mechanical Engineering and Naval Architecture marked the beginning of its work as a result of a merger of the Zagreb University Faculty of Mechanical Engineering and Naval Architecture and the Zagreb University College of Engineering. Three departments were instituted at the Faculty: mechanical/designing, mechanical/manufacturing and shipbuilding, while the engineering line of Engines and Vehicles was set up with the Department of Mechanical Engineering and Designing. In the academic year 1978/1979 a modified curriculum was adopted while the line of engineering changed the name into Engines, Vehicles and Transport in Industry. This line of study involved the courses Water, Fuel and Lubricants (2+1 hrs), Light Engines (4+2 hrs), Propulsion Engines (2+0 hrs), Rail Locomotives (4+2 hrs), Motor Vehicles (4+2 hrs), Transport in Industry (4+2 hrs), Light Engines - Laboratory Demonstrations (0+4 hrs), Motor Vehicles - Laboratory Demonstrations (0+4 hrs), Demonstrations in Structural Design (0+4 hrs) and Introduction to Graduation Thesis (Structural Design Demonstrations) 0+4 hrs.

In the academic year 1981/1982 a reformed curriculum was adopted at the final part of the course of university studies for a degree in mechanical engineering had three lines of study: Mechanical Engineering in Manufacturing Applications, Me-

vozila", "Zrakoplov i motor", "Klasično naoružanje" i "Zrakoplovno naoružanje". U ove skupine uvedeni su sljedeći predmeti iz područja motora i vozila:

- "Motori s unutarnjim izgaranjem"	VI/2+1
- "Mlazni motori"	VII/4+2
- "Uređaji mlaznih motora"	VIII/3+1
- "Mlazni motori - semestralni rad"	VIII/0+4
- "Motori"	VII/4+3
- "Motorna vozila I"	VII/3+1
- "Motori i motorna vozila - semestralni rad"	VIII/0+4
- "Ispitivanje motornih vozila"	VIII/1+3
- "Motorna vozila II"	VIII/3+1
- "Oklopna motorna vozila"	VIII/4+3
- "Inženjerski strojevi"	VIII/2+2
- "Tehnologija održavanja motornih vozila"	VIII/3+1

Na Fakultetu je 1963. godine organiziran postdiplomski studij pod naslovom "Tehnologija i organizacija strojarke proizvodnje". U trećem semestru studija nastava se odvijala po usmjerenjima, a jedno usmjerenje bilo je "Motori i motorna vozila" s predmetima:

- "Odabrana poglavlja iz teorije vibracija i vibracijske izolacije"
- "Eksperimentalna analiza naprezanja"
- "Odabrana poglavlja iz teorije i konstrukcije motora s unutarnjim izgaranjem"
- "Odabrana poglavlja iz teorije i konstrukcije motornih vozila"

Godine 1978. došlo je do promjene nastavnog plana postdiplomskog studija s uvođenjem sedam smjerova. U okviru smjera "Teorija konstrukcija" uveden je modul "Motori i vozila" s predmetima, svojstvenim za smjer, "Teorija i konstrukcija vozila" i "Teorija i konstrukcija motora", svaki predmet s po 25 sati predavanja.

Profesori našeg Fakulteta sudjelovali su u uvođenju nastave iz područja motora i iz vodili nastavu na drugim fakultetima, npr. na Studiju prometa (Sveučilišni interfakultetski studij), Agromskom fakultetu, Strojarskom fakultetu u Slavonskom Brodu.

3. INTERES STUDENATA ZA NASTAVU IZ PODRUČJA MOTORA I VOZILA

Interes studenata za određenu nastavnu disciplinu moguće je procijeniti prema raznim kriterijima, a svakako je znakovit broj diplomiranih studenata na odgovarajućem usmjerenju. Odlučili smo se za taj kriterij jer su nam potrebni podaci dostupni. Podaci koje navodimo temelje se na evidenciji Katedre za motore i vozila, a odnose se na studente koji su diplomirali na predmetima discipline "Transportna sredstva" ("Laki motori", "Motorna vozila", "Lokomotive", "Sredstva unutarnjeg transporta", "Prenosila i dizala"). Veći je broj studenata diplomirao iz područja stacionarnih i brodskih motora kod prof. Milera, prof. Mikuličića i prof. Šneller, što nije uneseno u ovu evidenciju. Prvi diplomirani studenti iz područja koje pokriva Katedra za motore i vozila pojavili su se 1949. godine, pa i naš pregled počinje s podacima iz te godine.

Ovi su podaci uspoređeni s brojem diplomiranih inženjera na Fakultetu. U središnjem popisu Fakulteta vodi se evidencija o broju diplomanata ukupno na Fakultetu i po smjerovima, ali ne i po usmjerenjima.

Nastava na dodiplomskom studiju FSB nije organizirana i nikada nije bila organizirana kao specijalistička, već su smjerovi i usmjerenja zamišljeni kao nastavne grupe u kojima se obavljaju

mehanical Engineering Structures, and Processing/Powering, while the training in the field of engines and vehicles within the scope of the teaching discipline Transportation Means was provided on the line of study Mechanical Engineering Structures. The respective division per lines of study started in the fifth semester. The discipline of Transportation Means included the following courses:

- Transporters and Cranes	VI/4+2
- Transporters and Cranes, Seminar Project	VI/0+4
- Locomotives	VII/4+2*
- Internal Circulation Motor Pool	VII/4+2*
- Fuels and Lubricants	VII/2+1*
- Engines	VIII/6+2
- Motor Vehicles	VIII/4+2
- Engines and Motor Vehicles, Practical Training	VIII/0+6
- Engines and Motor Vehicles, Semester Project	VIII/0+4
- Vehicle Dynamics	VIII/2+1*
- Testing of Motor Vehicles	VIII/2+1*

(Elective courses have been marked with asterisk*)

Since the academic year 1994/1995 the instruction in the line of study Mechanical Engineering Structures has been extended to include the groups of subjects of interest to the Croatian Armed Forces.

These refer to Military Motor Vehicles, Aircraft and Engine, Conventional Weapons, and Aircraft Armaments. The following courses from the field of engines and vehicles have been introduced into these groups of subjects:

- Internal Combustion Engines	VI/2+1
- Jet Engines	VII/4+2
- Jet Engine Units	VIII/3+1
- Jet Engines - Semester Project	VIII/0+4
- Engines	VII/4+3
- Motor Vehicles I.	VII/3+1
- Engines and Motor Vehicles - Semester Project	VIII/0+4
- Testing of Motor Vehicles	VIII/1+3
- Motor Vehicles II.	VIII/3+1
- Armoured Motor Vehicles	VIII/4+3
- Engineer Corps Machines	VIII/2+2
- Technology of Maintenance of Motor Vehicles	VIII/3+1

In 1963 the Faculty started post-graduate studies in Technology and Management of Machine Manufacturing. In the third semester the postgraduate course of studies was organized per individual lines of which one was Engines and Motor Vehicles with the following courses:

- Selected Chapters from the Theory of Vibrations and Anti-Vibration Protection
- Experimental Strain Analysis
- Selected Chapters from the Theory and Structure of Internal Combustion Engines
- Selected Chapters from the Theory and Structure of Motor Vehicles.

In the year 1978 the curriculum of the post-graduate studies was changed to include seven lines of study. Within the scope of the line of study Theory of Structures the module Engines and Vehicles was introduced with courses typical of the line of study Theory and Structure of Vehicles and Theory and Structure of Engines, each including 25 hours of lectures.

The professors from our Faculty participated in the introduction of university instruction in the field of engines and went on visiting professor assignments to other faculties as for instance Traffic Engineering Studies (Inter-faculty University Studies),

Tablica 1. Pregled broja diplomiranih inženjera na Katedri za motore, vozila i transport u industriji i na Fakultetu strojarstva i brodogradnje

Table 1. Review of the Number of Graduate Students at the Department of Engines, Vehicles and Transport in Industry and Total Numbers for the Faculty of Mechanical Engineering and Naval Architecture.

Godina Year	Diplomirali na Students who graduated from		Udio % Percentage share
	Katedri the Department	Fakultetu the Faculty	
1949.	1	27	3,7
1950.	3	34	8,8
1951.	1	20	5,0
1952.	10	126	7,9
1953.	11	122	9,0
1954.	14	113	12,4
1955.	13	142	9,2
1956.	14	113	12,4
1957.	19	154	12,3
1958.	17	94	18,1
1959.	19	89	21,3
1960.	12	131	9,2
1961.	21	124	16,9
1962.	31	166	18,7
1963.	21	145	14,5
1964.	12	106	11,3
1965.	15	89	16,9
1966.	17	103	16,5
1967.	18	233	7,7
1968.	16	148	10,8
1969.	13	100	13,0
1970.	16	148	10,8
1971.	18	166	10,8
1972.	16	173	9,2
1973.	22	167	13,2
1974.	17	184	9,2
1975.	30	268	11,2
1976.	28	298	9,4
1977.	37	298	12,4
1978.	30	401	7,5
1979.	19	249	7,6
1980.	13	314	4,1
1981.	20	313	6,4
1982.	30	308	9,7
1983.	18	274	6,6
1984.	15	230	6,5
1985.	14	172	8,1
1986.	4	122	3,3
1987.	8	151	5,3
1988.	4	160	2,5
1989.	12	204	6,9
1990.	14	215	6,5
1991.	13	187	7,0
1992.	20	205	9,8
1993.	21	254	8,3
1994.	26	201	12,9
1995.	21	158	13,3
Ukupno Total	784	8181	9,6

Faculty of Agricultural Engineering and Faculty of Mechanical Engineering of Slavonski Brod.

3. INTEREST OF STUDENTS IN TRAINING IN THE FIELD OF ENGINES AND VEHICLES

The interest shown by students in specific discipline of instruction can be judged by different criteria, however a major indicator is seen in the number of students graduating from the respective faculty department. We have chosen this criterion for reasons of having available the required data. The information provided originates from the records kept with the Department of Engines and Vehicles, for the students who took their graduation examination in the course of the discipline Transportation Means (Light Engines, Motor Vehicles, Locomotives, Internal Circulation Motor Pool, Transporters and Cranes). A large number of students took their graduation examination in the field of stationary and marine engines. Their tutors were Professor Miler, Professor Mikuličić and Professor Šneller, while the respective information isn't part of the subject records we have used. The first graduate students in the field covered by the Department of Engines and Vehicles were conferred their Bachelor's Degree back in 1949; for this reason our review starts with the 1949 data.

The available figures have been compared with the total number of students who have over the period graduated from the Faculty. The central register of the Faculty includes records on the total number of graduate students on the faculty and department level however no information is available for individual lines of study.

Instruction on undergraduate course of studies with the Faculty of Mechanical Engineering and Naval Architecture is not organized and has actually never been organized as a specialist training; in contrast the course and lines of study have been conceived as groups of subjects serving to provide for slight orientation of students on to the specific narrower segment of mechanical engineering. The share of technical (engineering) subjects being profession oriented indicative of individual line of study makes 18% as compared to overall study courses. Yet, upon completion of studies, the students who graduated from our department aspired to find employment in the field of manufacturing of vehicles and their parts, and maintenance of these machines either in the country or abroad. Many of graduate students of this line of study have won recognition in the profession. If we review the data provided in Table 1 we see that 784 students graduated from our department making a 9,6% share of the total number of graduate engineers conferred their engineering degree from the Faculty. This speaks of a major teaching commitment of our department, and of comparatively great interest of students in this profession, with no regard to the fact that this line of study involves comparatively higher work load for students, being required to elaborate comprehensive construction programs.

A large number of graduate engineers conferred their Bachelor's Degree in the line of study covered by our Department has shown interest in research work, as indicated by the number of Masters of Sciences (42) or 6% of total Master's degrees taken at our Faculty as well as the number of Doctors of Sciences (23) or 9,6% of total Doctor's degrees taken at our Faculty. Some detailed information on the number of master's and doctor's degrees conferred is given in Table 2 and 3. Considerable hindrance to a

Tablica 2. Pregled magistara znanosti iz područja motora i vozila na Fakultetu strojarstva i brodogradnje**Table 2. Review of the Number of Master's Degrees in the Field of Engines and Vehicles Conferred at the Faculty of Mechanical Engineering and Naval Architecture**

Godina Year	Broj Number
1971.	4
1972.	1
1973.	2
1974.	1
1976.	1
1977.	1
1978.	4
1979.	2
1980.	2
1981.	2
1982.	3
1983.	2
1984.	7
1985.	2
1986.	3
1988.	1
1989.	1
1990.	2
1993.	1
Ukupno Total	42

samo blago usmjeravanje studenata na određenu užu granu strojarstva. Udio stručnih predmeta znakovitih za usmjerenje u odnosu na cijeli studij iznosi oko 18%. Ipak, nakon završetka studija, težnja diplomiranih studenata našeg usmjerenja bila je zapošljavanje u području proizvodnje transportnih sredstava i njihovih dijelova te održavanja tih strojeva, bilo u zemlji ili inozemstvu. Mnogi od završenih studenata na ovom usmjerenju postigli su značajnu afirmaciju u struci. Ako se pogledaju podaci u tablici 1., vidi se da je na Katedri diplomiralo 784 studenta što je 9,6% od ukupnog broja diplomiranih inženjera. To dokazuje značajnu nastavnu aktivnost naše katedre, a isto tako relativno velik interes studenata za ovu struku, bez obzira na to što je izbor ovog usmjerenja za studente značio relativno veće opterećenje, jer su morali izraditi opsežne konstrukcijske programe.

Znatno broj diplomiranih inženjera na našem usmjerenju pokazao je interes za znanstveni rad, što dokazuje broj magistara znanosti (42) ili 6% ukupno magistriranih na Fakultetu kao i doktora znanosti (23) što je 9,6% ukupno doktoriranih na Fakultetu. Potanji podaci o broju magistara i doktora znanosti dani su u tablicama 2. i 3. Znatnu zapreku u intenzivnijem razvoju znanstvenog rada predstavlja i predstavljao je nedostatak znanstvene opreme u laboratoriju. Naša oprema, osim kompjutorske, starija je od 30 godina, a koristi se još uvijek i oprema nabavljena u razdoblju od 1941. do 1945. godine, u teškim uvjetima Drugoga svjetskog rata.

Na Fakultetu strojarstva i brodogradnje magistriralo je ukupno 695 magistara znanosti.

Ukupno je na Fakultetu strojarstva i brodogradnje doktoriralo 240 kandidata.

Broj nastavnika koji djeluju na Fakultetu i Katedri naveden je u tablici 4.

Tablica 3. Pregled obranjenih disertacija iz područja motora i vozila na Fakultetu strojarstva i brodogradnje**Table 3. Review of Defended Doctoral Thesis in the Field of Engines and Vehicles at the Faculty of Mechanical Engineering and Naval Architecture**

Godina Year	Broj Number
1979.	2
1980.	1
1981.	1
1984.	1
1985.	2
1987.	3
1988.	1
1989.	1
1990.	1
1992.	1
1993.	4
1994.	4
1995.	1
Ukupno Total	23

more intense development of research presents and has always presented the scarce research equipment in our Laboratory. Our equipment, except for computers, was procured more than 30 years ago, while we still make use of the equipment provided in the period of 1941 to 1945 in the adverse conditions of the Second World War.

The Faculty of Mechanical Engineering and Naval Architecture conferred a total of 695 Master's Degrees.

A total of 240 Doctor's Degrees have been conferred by the Faculty of Mechanical Engineering and Naval Architecture.

The number of university teachers employed at the Faculty and our Department is shown in Table 4.

Tablica 4. Broj nastavnika koji djeluju na Fakultetu strojarstva i brodogradnje i Katedri za motore i vozila i transport u industriji**Table 4. Number of Personnel on Teaching Assignments at the Faculty of Mechanical Engineering and the Department of Vehicle Engines and Transport in Industry**

Nastavno zvanje Capacity	Broj nastavnika na Fakultetu Number Employed at the Faculty	Broj nastavnika na Katedri Number Employed at the Department
Redovni profesor Professor	35	3
Izvanredni profesor Associate Professor	17	—
Docent Senior Lecturer	33	1
Predavač Lecturer	11	—
Asistent Assistant Lecturers	75	3
Ukupno Total	171	7

4. ZAKLJUČAK

Treba svakako podsjetiti na to da proteklo 70-godišnje razdoblje, blago rečeno, nije bilo naklonjeno razvoju motorne industrije i automobilske struke, gledano u cjelini, na području Republike Hrvatske. No i pored toga, predočeni podaci pokazuju da su u obrazovnom procesu iz područja motora i vozila na Fakultetu postignuti značajni uspjesi. Takav zaključak slijedi ne samo iz kvantitativnih pokazatelja, koji su izneseni, nego i iz kvalitete naših završenih inženjera, od kojih su mnogi, radeći u razvijenim zemljama Europe i svijeta, s uspjehom izdržali i međunarodnu verifikaciju svoga znanja i umijeća. Sve to možemo ponajprije zahvaliti doajenima motoristike u Hrvatskoj, u važnim pokojnim profesorima Mileru, Mikuličiću i Krpanu, koji su svojim znanjem i požrtvovnošću osnovali i razvili sveučilišnu nastavu ove grane strojarstva u Hrvatskoj.

Upirući pogled u budućnost, treba istaknuti značenje motora i vozila za gospodarstvo i svekoliki razvoj Republike Hrvatske, a posebno za jačanje njenih obrambenih potencijala. Stoga se valja nadati da će ova grana strojarstva u slobodnoj i neovisnoj Hrvatskoj dobiti znatniju podršku, što je u nastavnim dijelovima već započeto uvođenjem u nastavni plan i program posebnih sadržaja za potrebe Hrvatske vojske, koji su dobri dijelom usmjereni na motore i vozila. Laboratorijska oprema koju bi najprije trebalo nabaviti je ona za kontrolu sigurnosnih i ekoloških značajki vozila i motora. Ta bi oprema omogućila znanstveni rad i unaprijedila edukaciju kadrova na tom vrlo interesantnom i zahtjevnim području, a u praktičnom kontekstu postala bi osnovom za provedbu homologacijskih ispitivanja, koja su propisana međunarodnim pravilnicima i nacionalnim zakonskim propisima.

4. CONCLUSION

It should absolutely be reiterated that the past period of 70 years, to put it mildly, has not been in favour of the development of automobile industry and the profession as viewed on the whole, in the Republic of Croatia. Despite this fact, the information presented indicates that in the training process in the field of engines and vehicles at our Faculty major results have been reported. This conclusion has been drawn not only from the quantitative indices presented but from the established quality of our graduate engineers of whom many while working in progressive nations in Europe and in the world have successfully received verification of their knowledge and skills. This is the merit of the doyens of motor engines in Croatia, the esteemed late professors Miler, Mikuličić and Krpan, who did not spare their knowledge and efforts to institute and develop university training of this segment of mechanical engineering in Croatia.

Looking at the future, it should be reiterated that major is the import of engines and vehicles for the economy and overall development of the Republic of Croatia, in particular for the strengthening of its defense potentials. For this reason we strongly hope that this segment of mechanical engineering shall in liberated and independent Croatia receive strong support what has already been materialized in the educational segment by introduction of the specific subjects for the needs of the Croatian Armed Forces into the university curriculum, being for the most part oriented to engines and vehicles. Laboratory equipment that should be procured first involves the instruments for control of safety related and ecological aspects of engines and vehicles. This equipment should promote research education in this rather interesting and requiring field, while in the practical sense it would become the basis for the completion of homologous tests as prescribed by international rules and national regulations.