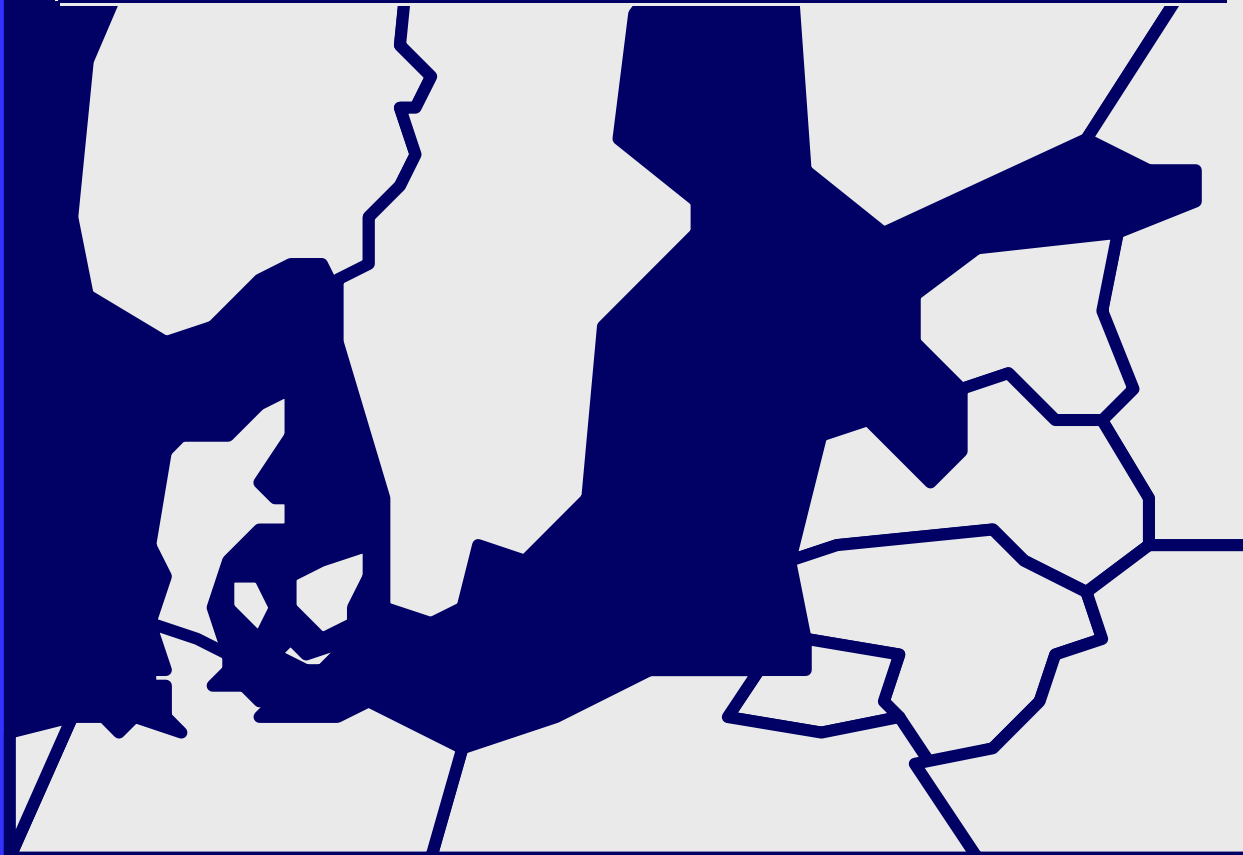
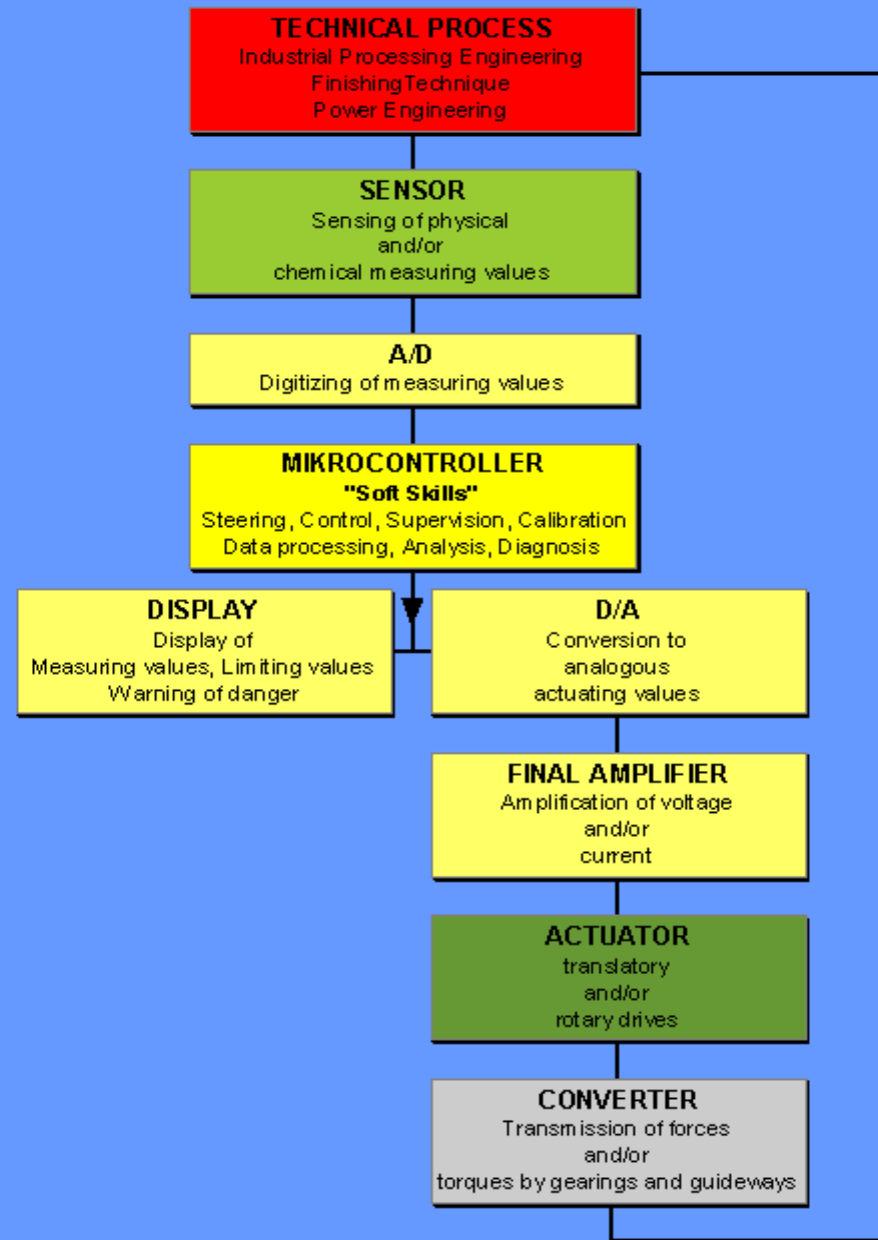
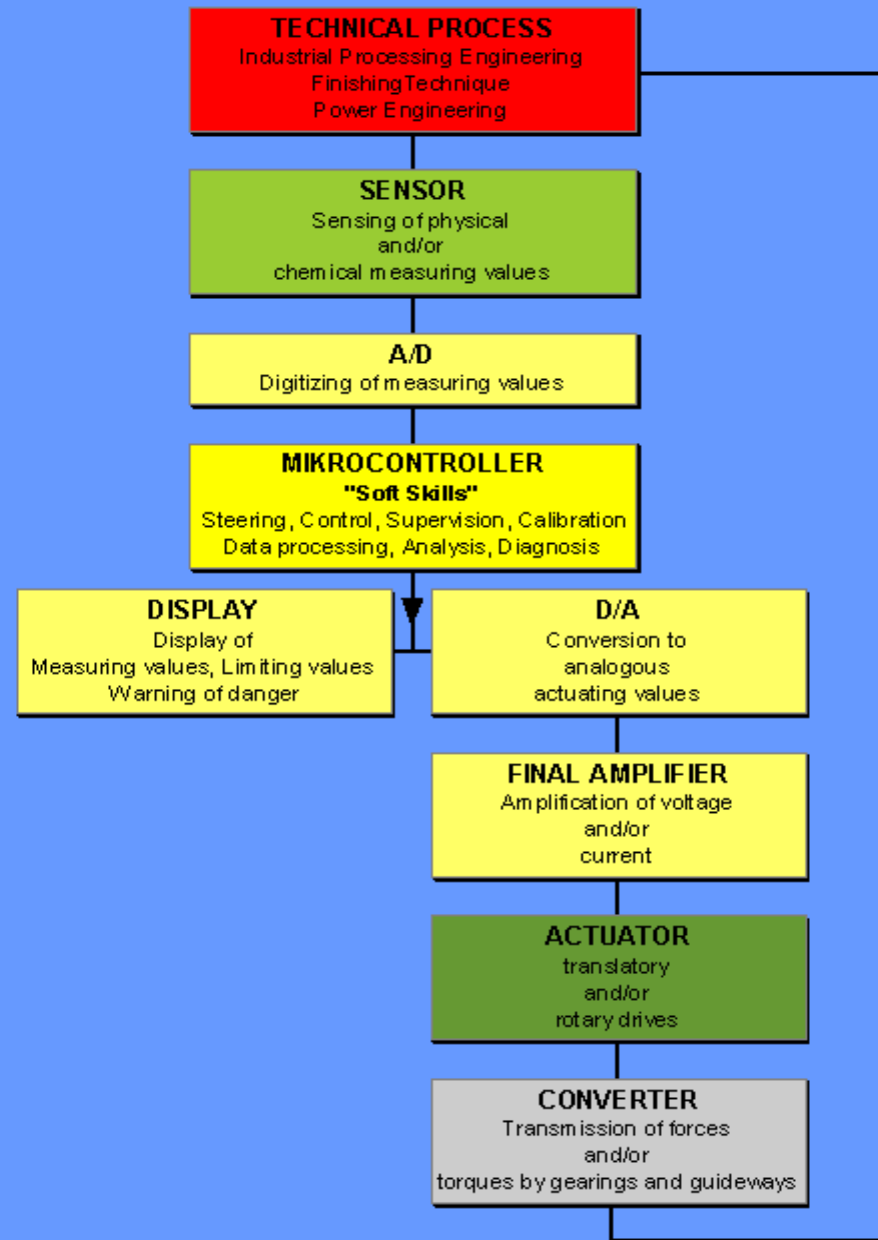


Education in Mechatronics as an International Study

Conditions for its Realization









What are reasons for the acceptance of the term „mechatronics“ in Germany?

1950 till 1989	Politics and Economics	Technical Universities	Universities of Applied Sciences
	reduction of technical staff in industry (retreat with the age of 58) 1989 the Wall came down	overcrowded more education than R&D	overcrowded education only
the early nineties	<ul style="list-style-type: none"> ▪ Reunion of Germany ▪ Common market within the European Union ▪ Concentration of economic power within the European Union ▪ Internationalisation ▪ Globalisation ▪ Economy declines world wide ▪ Forced reduction of technical staff in industry 	<ul style="list-style-type: none"> ▪ Number of beginners diminishes dramatically in the natural sciences, in physics and chemistry as well as in mechanical and electrical engineering ▪ Reduction of teaching staff (professors and assistents *) ▪ Reduction of personnel in the academic administration *) ▪ Reduction of finances for education *) 	<ul style="list-style-type: none"> ▪ Number of beginners diminishes dramatically in the natural sciences, in physics and chemistry as well as in mechanical and electrical engineering ▪ Reduction of teaching staff (professors and laboratory engineers *) ▪ Reduction of personnel in the academic administration *) ▪ Reduction of finances for education *) ▪ Permission of R&D

*) not in every Federal Country of Germany



What are reasons for the acceptance of the term „mechatronics“ in Germany?

<p>the late nineties</p>	<p>increasing want of engineers</p>	<ul style="list-style-type: none"> ▪ increasing discussion about lazy professors ▪ thoughts about control of professors' effort ▪ “autonomy” of the university with fixed budget *) 	<ul style="list-style-type: none"> ▪ R&D becomes duty ▪ proceeding reduction of finances for education *) ▪ specialization and concentration of education *) ▪ increasing discussion about lazy professors ▪ thoughts about control of professors' efficiency ▪ “autonomy” of the university with fixed budget *)
<p>the future</p>	<ul style="list-style-type: none"> ▪ 10.000 to 50.000 engineers missing in the German industry ▪ danger of depression of R&D in the German industry with hard economic consequences 	<ul style="list-style-type: none"> ▪ salary for professors corresponding to their effort 	<ul style="list-style-type: none"> ▪ salary for professors corresponding to their efficiency

*) not in every Federal Country of Germany



What are reasons for the acceptance of the term „mechatronics“ in Germany?

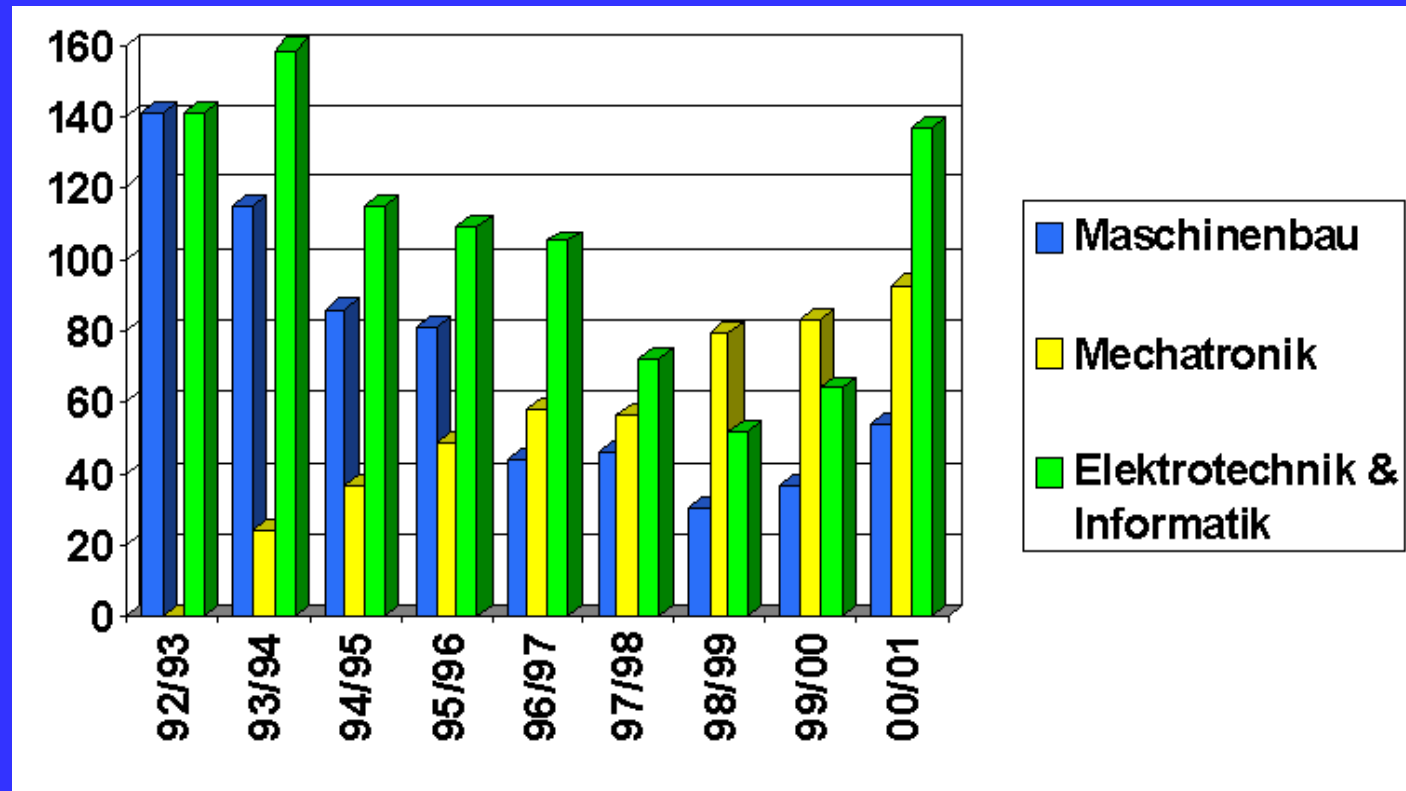
A new word haunted German universities in the middle of the nineties,

„Innovation“

The time for the term „Mechatronics“ had come



Numbers of Beginners at the University of Applied Sciences Bochum





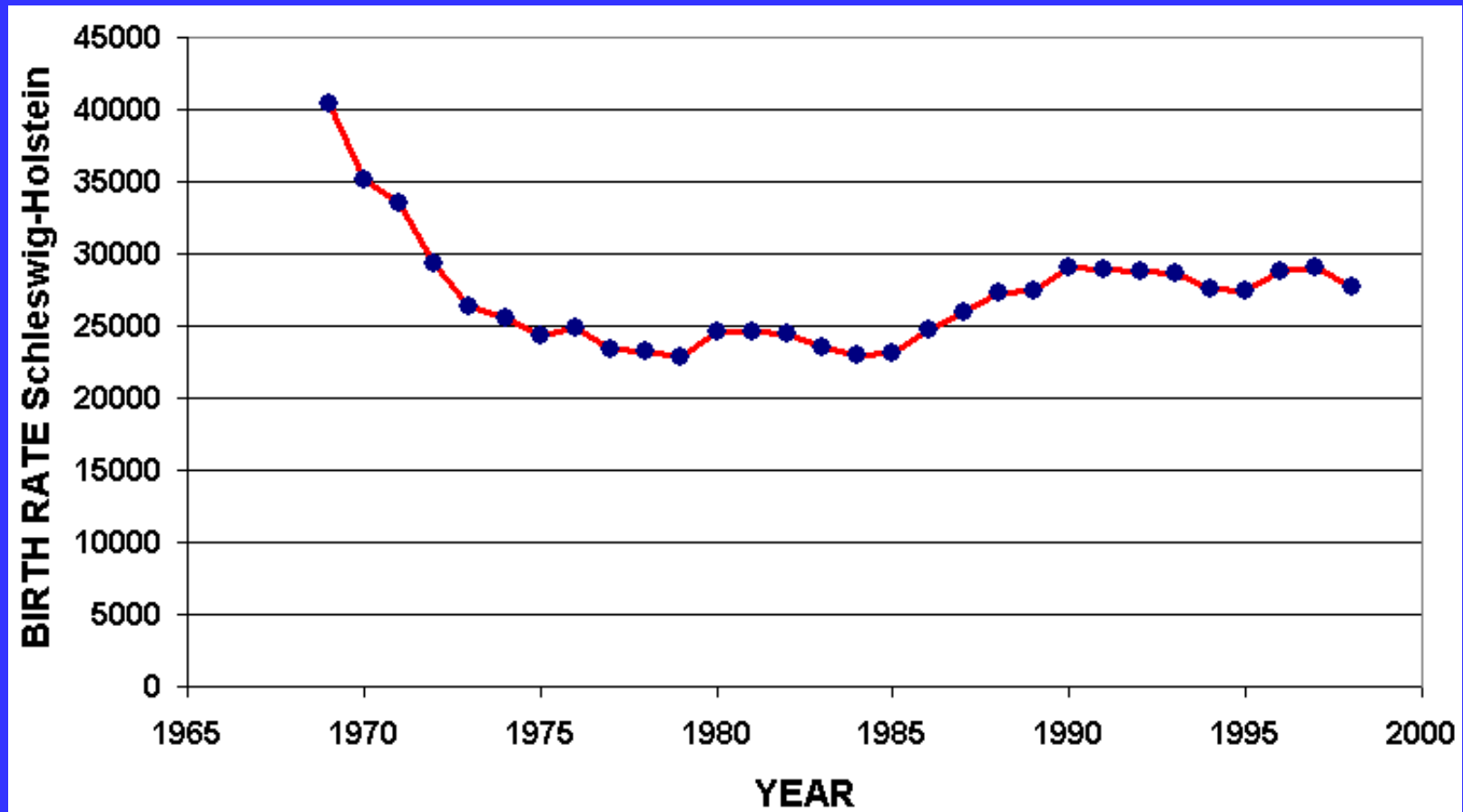
Financial reasons will force us to a more economic use of our teaching resources

The situation found at the German Technical Universities at the beginning of this century is

- Less teaching staff
- Less money for education
- Not sufficient money for research and development
- No hope for an increasing number of students

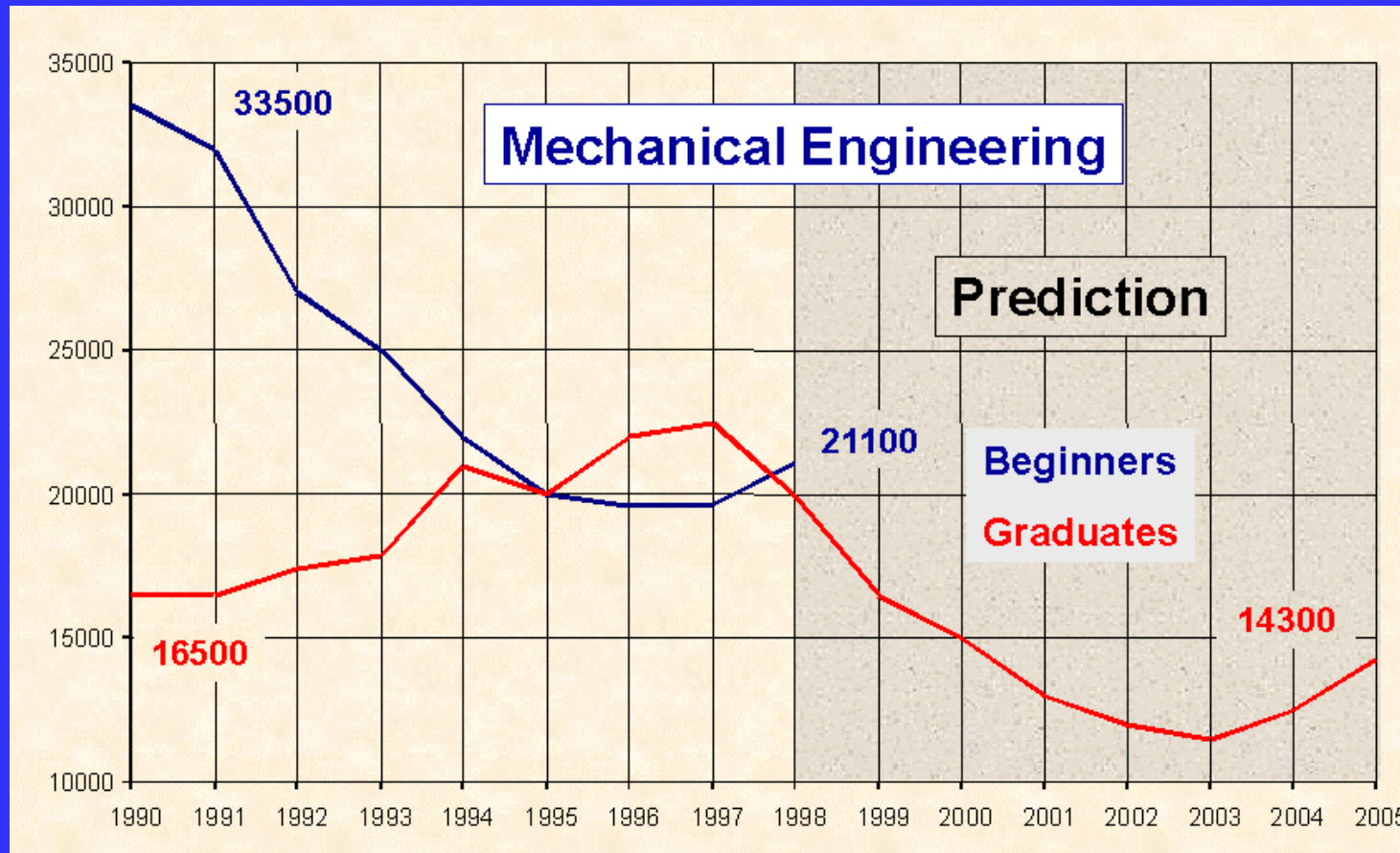


Development of Birth Rate in the Federal State Schleswig-Holstein



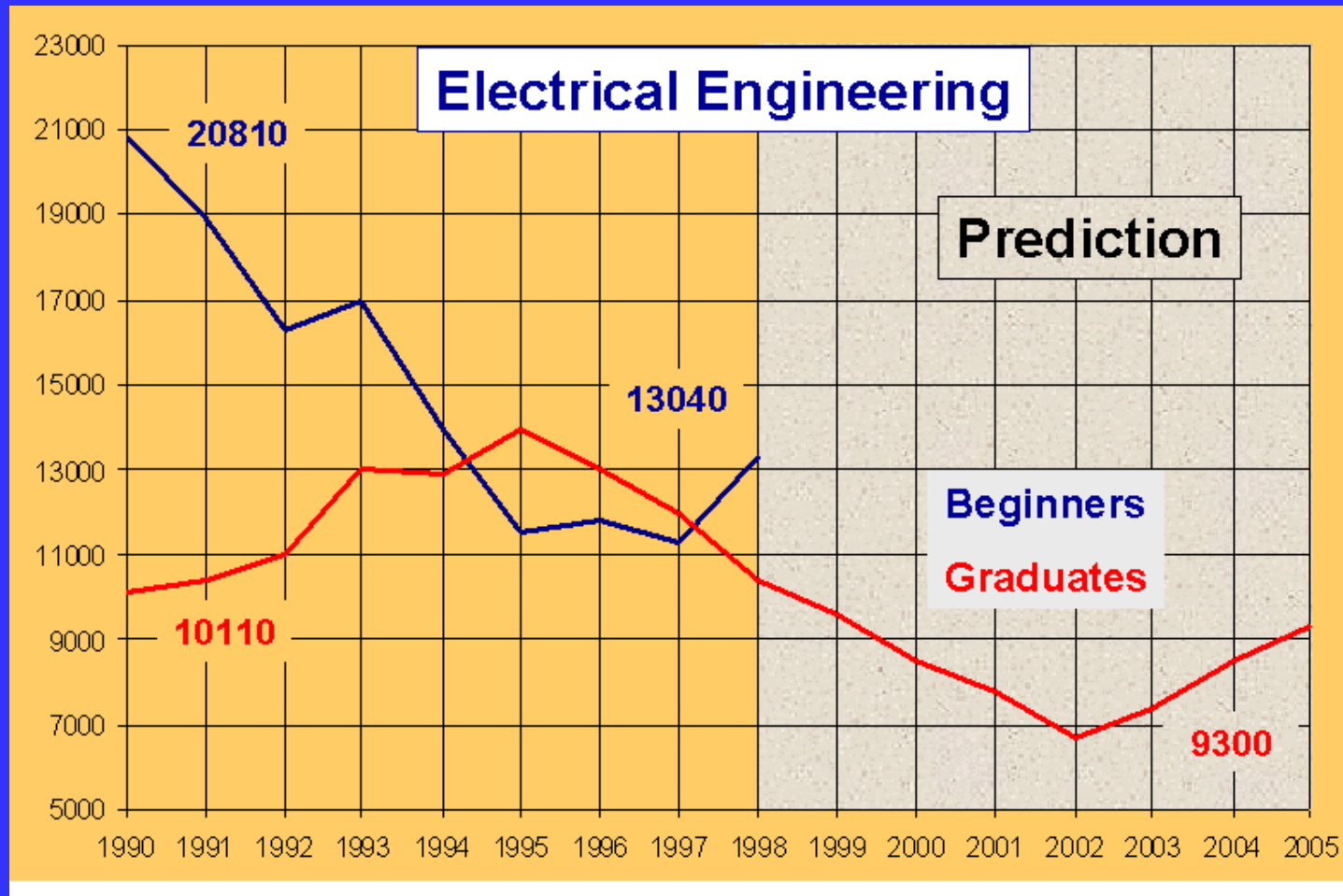


Number of Beginners and Graduates in Mechanical Engineering



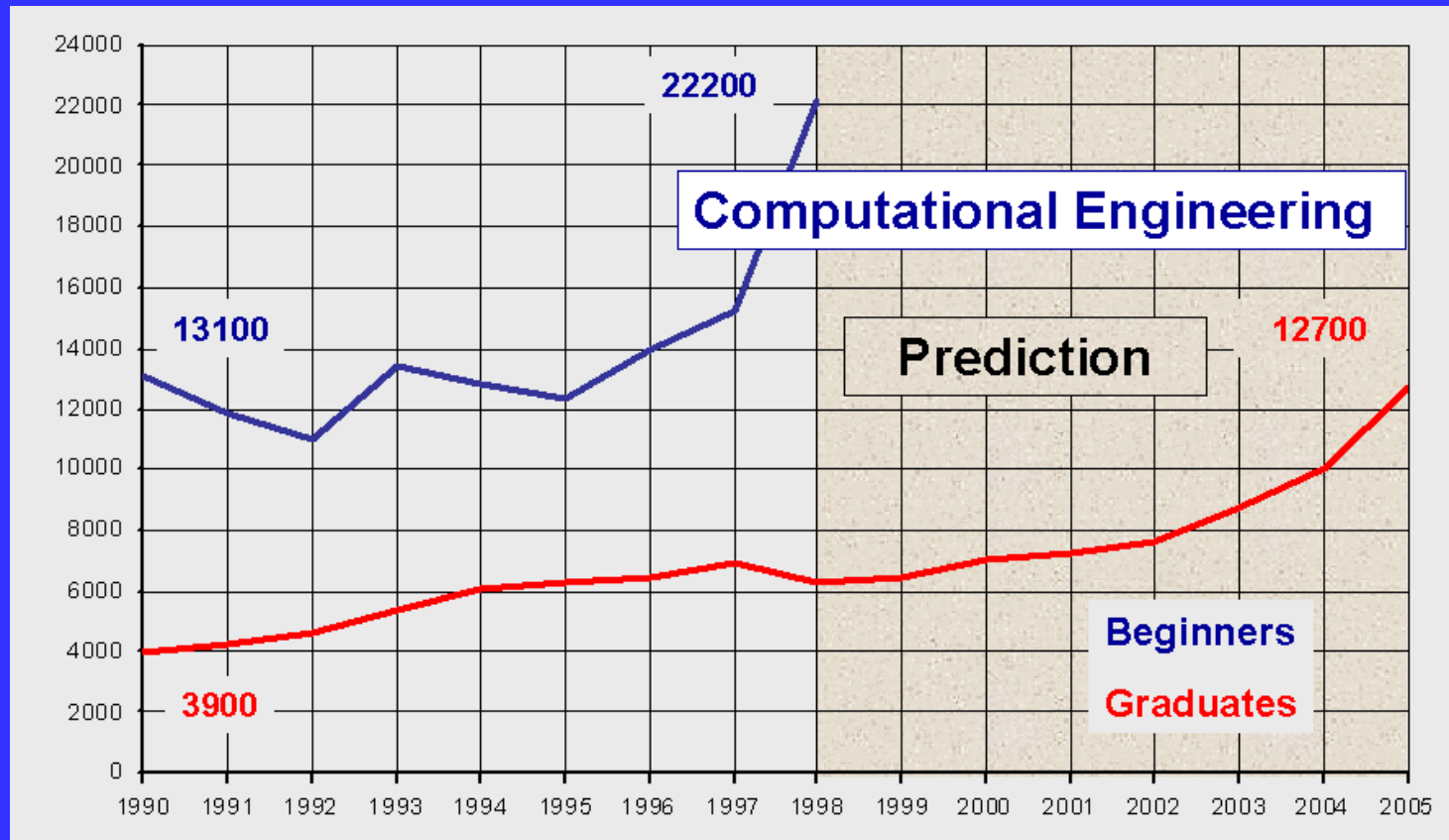


Number of Beginners and Graduates in Electrical Engineering





Number of Beginners and Graduates in Computational Engineering





The Future for the German Technical Universities

- They will never have as many students as ever before, because of
 - demography of the German population
 - the decreasing interest of young people in technical studies
- they will be forced to educate with very low financial resources



The Result for the German Industry

- The gap between graduates in engineering sciences and the need for engineers will increase
- No reservoir of engineers



The personnel and financial situation of the universities will stagnate or even get worse.

To manage this situation technical universities and industry will have to do every feat together to secure for a sufficient rising generation of engineers.

No help will come from outside, the university will have to help itself, meaning the finances will force us to a more economic use of our teaching resources

This would mean that we should think about new ways in teaching.



The European Aspect of Engineering Education an Opportunity for Mechatronics

Consequences

- The right of free choice of working place within the European Union
- Chances depend on quality of education
- Mechatronics is a discipline just about to be established
- Unique opportunity to create a study program in mechatronics accepted in each country bordering on the Baltic Sea thus raising the vocational chances of our graduates



The European Aspect of Engineering Education an Opportunity for Mechatronics

Consequences

A study program in Mechatronics with equal basic disciplines gives our students the possibility to leave their university and continue their studies at another university of another country without any loss of time.



The European Aspect of Engineering Education an Opportunity for Mechatronics

Consequences

- International experience,
- studies at a foreign university,
- practical working experience in a foreign country,
- knowledge of a foreign language

are more and more decisive for the future job.



What can the University, especially, what can the teaching staff do?

Development of Education

EDUCATION	MOTION	
till now	students are coming to the professors	
the future in theory	professors are coming to the students	nobody is coming to anyone the virtual university
the future in practice	a combination of the 3 possibilities above	

The future of teaching will be a mixture between

- the traditional way,
- of courses by guest-professors
- and of virtual education



An international study program in Mechatronics could differ from university to university, but should it?

With regard to economy it should not!

It must be possible to create a study program of mechatronics which is uniform in the basic disciplines at every university of each state bordering on the Baltic Sea, thus giving the universities the possibility of specialisation in those disciplines, which are

- of special interest for the state
- main emphasis of the university research
- characterizing an institution of a university



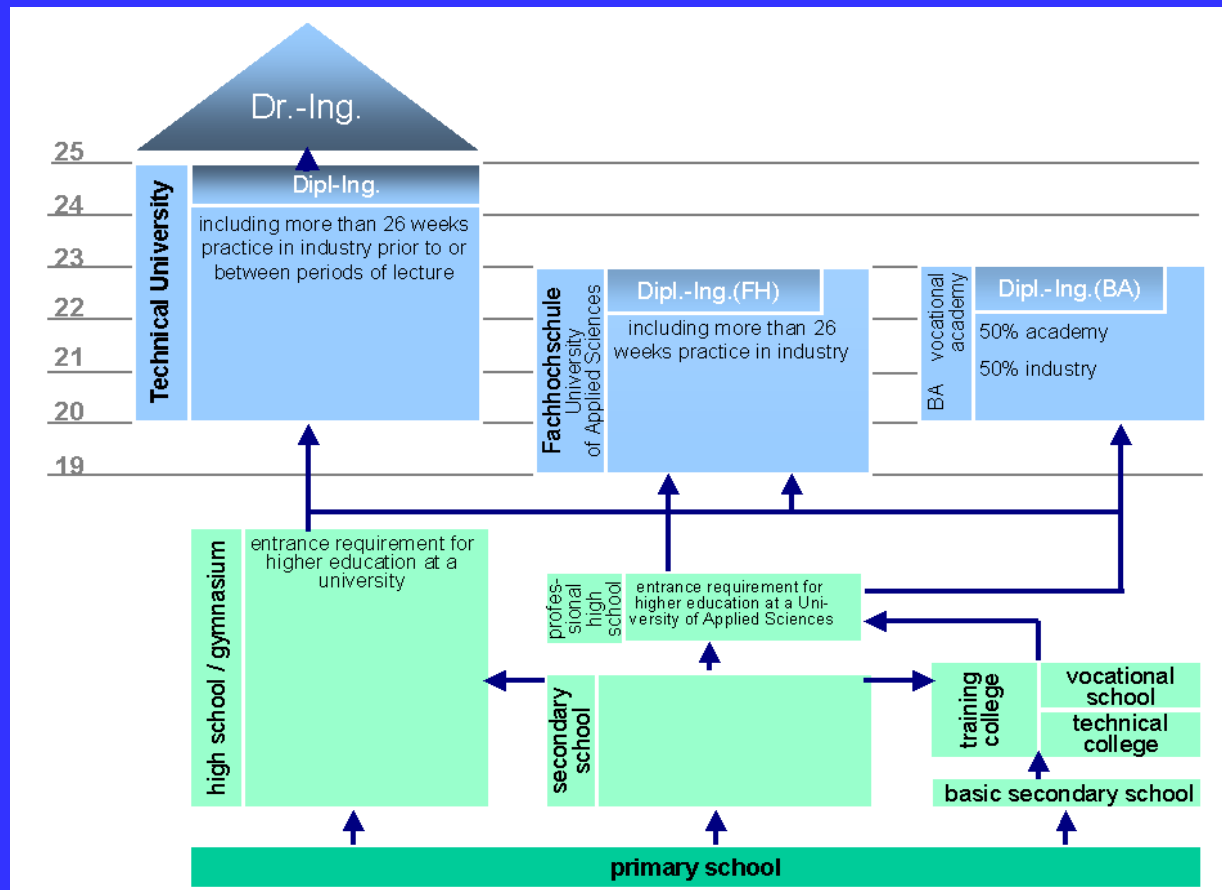
What are the conditions for an International Study Program of Mechatronics?

First of all we should get familiar with the graduation system usual in each country bordering on the Baltic Sea.



Conditions for an International Study Program of Mechatronics

The German Education System





Conditions for an International Study Program of Mechatronics

Differences between education at University and University of Applied Sciences

Technical University	University of Applied Sciences
10 compulsory semesters	8 compulsory semesters
Practical work prior to or between periods of lecture	Practical work prior to study and as a full semester (normally the 5 th semester)
No special semester for diploma thesis	8 th semester for diploma thesis



What are the conditions for an International Study Program of Mechatronics?

First of all **we should get familiar with the graduation system** usual in each country bordering on the Baltic Sea.

A second thing **we need is an international agreement on the number of hours** for an international study program in mechatronics.

A third thing **we need is an international agreement to the disciplines necessary** for mechatronics **and the contents** of these disciplines.



Do we have a chance to have success?

Within the nineties

- the Universities started to involve more practice into engineering education
- the Universities of Applied Sciences raised theory in their lectures
- both developed education models containing practical developing and research work as a possibility of combining theory with practice to increase understanding of complex theoretical connections and to raise motivation in studying
- most study programs in mechatronics have been made uniform to a high degree