IMPACT OF TEMPUS PROJECTS ON THE COMPUTER ENGINEERING COURSES AT THE TECHNICAL UNIVERSITY OF WROCLAW

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This paper describes the computer engineering education at the Electronics Faculty of the Technical University of Wroclaw. Special attention is paid to the Microprocessors and Microcomputer Systems Courses, which are mainly realised in the Institute of Engineering Cybernetics. Two TEMPUS JEPs are conducted in this Institute.
A short presentation is given of the Informatics at the University, the Electronics Faculty and the Institute. Two computer engineering curricula ("old" and "restructured") are presented and on this basis the influence of the TEMPUS projects on the computer engineering education is shown.

1. Terminology

The name Informatics (in Polish: Informatyka) is commonly used in reference to Computer Science and Computer Engineering in Poland. Research and education in this field are conducted at universities (theory of informatics, numerical methods, software), at economics academies (applications and software) and at technical universities (hardware, software and applications).

In this paper "computer engineering" means informatics research and education that are carried out at the electronics faculties of technical universities and it is mainly connected with designing, construction and applications of digital devices and computer systems.

2. Informatics at The Technical University of Wroclaw

The Technical University of Wroclaw is one of the biggest universities in Poland and it is the second among technical universities. The University is divided into 11 faculties with 8.000 students and almost all of them take only M.Sc. courses (10 semesters). The staff of the University is composed of 46 full professors, 1996 professors and lecturers (more then 80% of them hold Ph.D. degree).

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Informatics education is carried out at the Electronics Faculty (the computer engineering) and at the Informatics and Management Faculty (information systems dedicated to libraries, software and applications).

The Electronics Faculty with 1.400 students is the biggest at the University. There are five institutes (Fig. 1): the Institute of Telecommunication and Acoustics is the largest (academic staff: 100) and the Institute of Control and Systems Engineering is the smallest (academic staff: 42). The Institute of Engineering Cybernetics (IEC) is second with 2 full professors, 7 professors, 47 assistant professors (with Ph.D. degrees) and 23 assistants (with M.Sc. degrees).

The IEC is divided into 6 units (Fig. 2) which are responsible for research and teaching processes. Every year, the Institute supervises about 90 diploma projects (at the academic year 1991/2). The students receive their M.Sc. degrees in Electronic Engineering as specialists in:

- Microprocessors and Microcomputer Systems (30 %),
- Industrial Automation and Robotics (10%),
- Control Engineering (60%).

The computer engineering direction has two specialisations:

- Microprocessors and Microcomputer Systems (30 students on the fifth semester, i.e. the first specialisation semester, at the academic year 1991/2),
- Computer Networks (13 students).

IEC is mainly responsible for the first specialisation and the Institute of Control and System Engineering for the second. This division of responsibility is the result of some tradition and researches conducted by both Institutes.

The "old" computer engineering curriculum (created in 1989) is shown in Figures 3, 4 and 5. The basic course is common for both specialisations (Fig. 3) and the two separate specialisation courses start at the fifth semester. The final project is connected with the subject of M.Sc. dissertation and it ought to prepare students for independent research. In this way each student has one year and a half to prepare the M.Sc. dissertation.

Two TEMPUS JEPs are conducted in the Unit of Digital Engineering and Microcomputer Systems:

1. TEMPUS JEP 0449 ADVANCED COMPUTING EDUCATION PROJECT

   the co-ordinator: Professor Erik Dagless from the University of Bristol, for more details see the next chapter,

2. TEMPUS JEP 1087 COMPUTER - AIDED LEARNING AND SIMULATION TECHNOLOGIES

   the co-ordinator: Professor Michael S. Wald from Hamburg Ausbildungschaft, Hamburg. It includes design of instruction laboratory intended for computer-aided tuition in electrical and mechanical engineering. New methods and techniques of education in the field of engineering are expected to be invented as a result of the project.

The described above curriculum of the computer engineering courses is changing now with the following assumptions:

- a student should not have more than 28 hours coursework per week,
- there ought to be more optional subjects at each semester (5% of hours on each semester for the next academic year).

The most recent and just now being prepared curriculum is shown in Figures 6, 7, 8. It will be discussed in Chapter 4 as there is some influence of TEMPUS JEPs.

3. The Subject Areas of TEMPUS JEP 0449

The subject areas covered by the JEP are:

- advanced computer architecture,
- image and video processing,
- ASIC design and CAD.

JEP activities are the following :

Review and restructuring of the Curriculum

aims:

- a similar level of education at the co-operating universities
- creation of possibilities of student transfers between the universities

Upgrading of teaching laboratories

aims:

- creation of possibilities for up-to-date practical training skill in the given above project areas
- development of specialised hardware, software and course materials

comment:

- these are real possibilities of advanced computer technology transfer to the Wroclaw University laboratories

Organisation of the MICROCOMPUTER schools

aim:

- lectures on the key developments in computer engineering

comment:

- WORKSHOP'92 is organised instead of the MICROCOMPUTER.

Mobility of lecturing staff

aims:

- exchange of lecturing staff ,
- series of lectures for students and staff

comment:

- real possibility of exchanging teaching experience and getting to know "how the others are teaching the same",

Organisation of undergraduate study and postgraduate research training

aims:

- creation of possibilities for Polish students to take the final year of study in England,
- realisation of research tasks (specially in modern IC technology) related to completion of M.Sc. dissertations and Ph.D. Thesis,

comment:

- there are limited possibilities to give degrees to Polish students by English universities,
- the youngest Polish staff members are less interested in short visits abroad now

Practical placements with SGS-THOMSON

aim:

- creation of opportunity for Polish students and staff members to work in a team of highly skilled engineers using advanced CAD tools to create chips .

4. Consequences of TEMPUS JEPs Realisation

The TEMPUS JEP 0449 and JEP 1087 are realised since 1990 and now it is possible to show impact of their realisation on the computer engineering education at the IEC.

Generally new ideas appear in the curriculum and syllabus, new equipment and computer tools have been installed at our laboratories, a few staff members of the co-operating universities paid visits at partner schools, a few undergraduate students from Wroclaw started their study in England at this academic year.

Some formal changes are made in computer subjects of the **Basic Courses Curriculum** (Fig. 3 and 6). Some of the subjects are shortened (e.g. The Computer Architecture) or renamed (e.g. old "Programming Theory and Practice" is changing now into "Programming Practice"; "Design Devices and Circuits", and "Overview of Electronic Circuits" are combined into "Digital Circuits"). There is a new subject "Basic Software - Compilers" and three blocks of optional subjects (A, B, C) are introduced.

This formal renewal of Curriculum is connected with new syllabi and the main effect of the TEMPUS projects is made in laboratory practices, specially for the two subjects: "Introduction to Microprocessors" and "Digital Circuits". In these laboratories students study to measure physical parameters of digital circuits (on special kits UNILOG) and next they operate on the OrCAD and SPICE systems. The second tasks take nearly 80% of the lab time. This new program of the labs was introduced in the winter semester of the academic year 1991/2. It was made possible by the five new IBM AT computers and the OrCAD, which were granted by TEMPUS JEP 1087 and JEP 0449 .

More significant modifications are made in the specialising courses - compare Figures 4 and 5 with Figures 7 and 8. The following considerations are focused on the Microprocessors and Microcomputer systems specialisation.

There are new subjects; "Advanced Computer Architecture (transputer)", "Microprocessor Controllers", "Data Bases" , "Neural Nets", "Digital Circuits" and four blocks of optional subjects.

Advanced computer architecture will be trained on the transputer kits that were granted by the JEP 0449. This laboratory, together with "Compilator" (from the Basic Course) and "Microprocessor Controllers", create a new image of the important block of ARCHITECTURE subjects.

The transputer laboratory will be equipped with special image processing kits (made by Bristol University) and it will be a basis for modernisation of subjects: "Computer graphics" and "Image processing". This laboratory will make possibility the up-to-date research in the computer vision area, too.

TEMPUS JEP 0449 has the largest impact on education in computer aided design techniques. Formally there is only one optional subject in the Basic Course (8 semester) and one optional subject in the Specialising Course. The last is "ASIC design" and it gives students opportunity to train in the methodology of using FPGAs. As it was mentioned above, the teaching of CAD tools is started during the "Introduction to Microprocessors" and specially at the "Digital Circuits", with a new approach to logic design based on Top - Down approach, HDL, programmable devices etc.

In this way, there are following paths of education in computer aided design techniques :

- OrCAD and SPICE on the Basic Course,
- OrCAD - Logic Simulator and CUPL again on the Basic Course,
- OrCAD / VHDL and XILINX for ASIC design on the Specialising Course. Probably, there will be possibility, during diploma projects, to design the standard cell VLSI on the basis of SOLO 1400 .

The XILINX tool is ready to use in the high skilled student education and the SUN Sparc Workstation will be ready in a few months too. On this basis I believe that in the next academic year a few of our students will design and possibly manufacture the first ASIC circuits.

5. Conclusion

The TEMPUS projects help us to change the educational profile of the computer engineering courses at the Wroclaw Technical University. Previously it were preparing engineers for designing and constructing microprocessor systems for various applications. Now the University intends to provide these same engineers with additional skills and knowledge required to design specialised ICs.

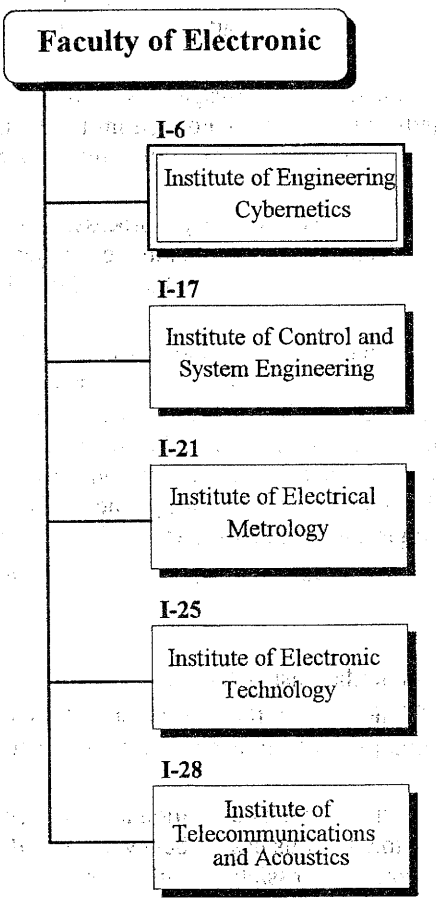

Fig. 1. Structure of the Faculty of Electronics, Technical University of Wroclaw.

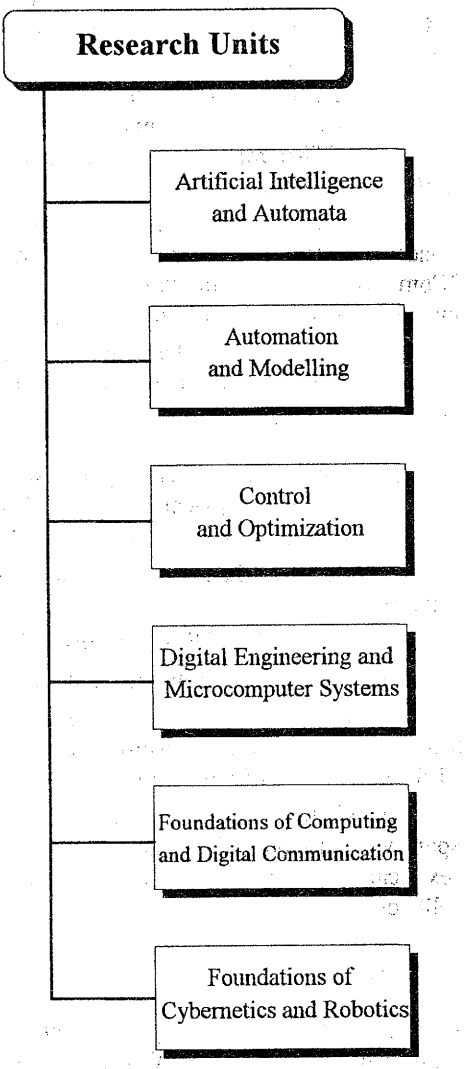

Fig. 2. Structure of the Institute of Engineering Cybernetics (IEC).

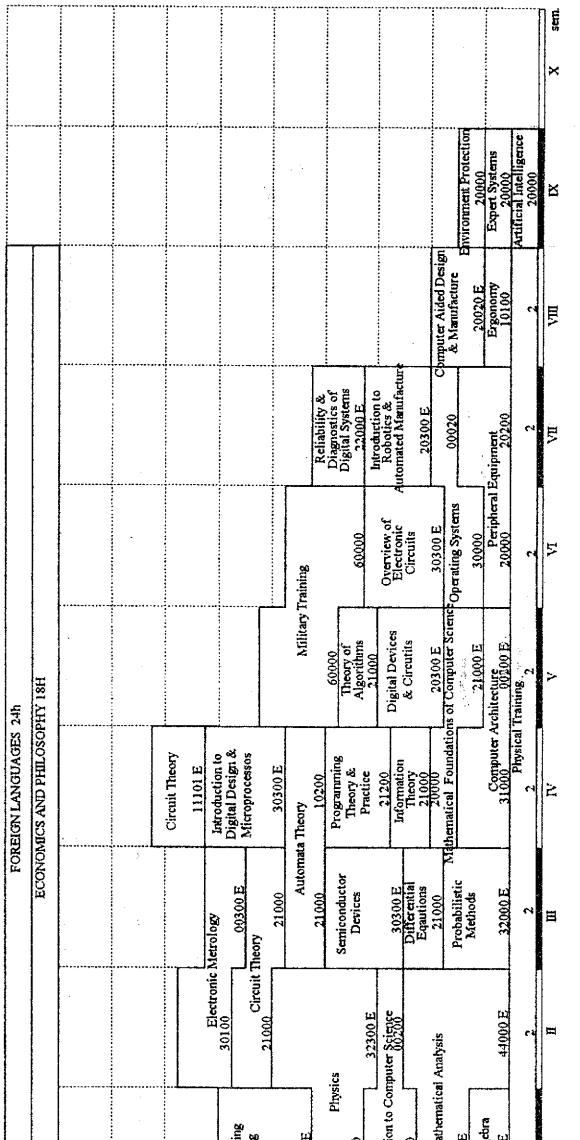

Fig. 3. Old version of the basic course curriculum.

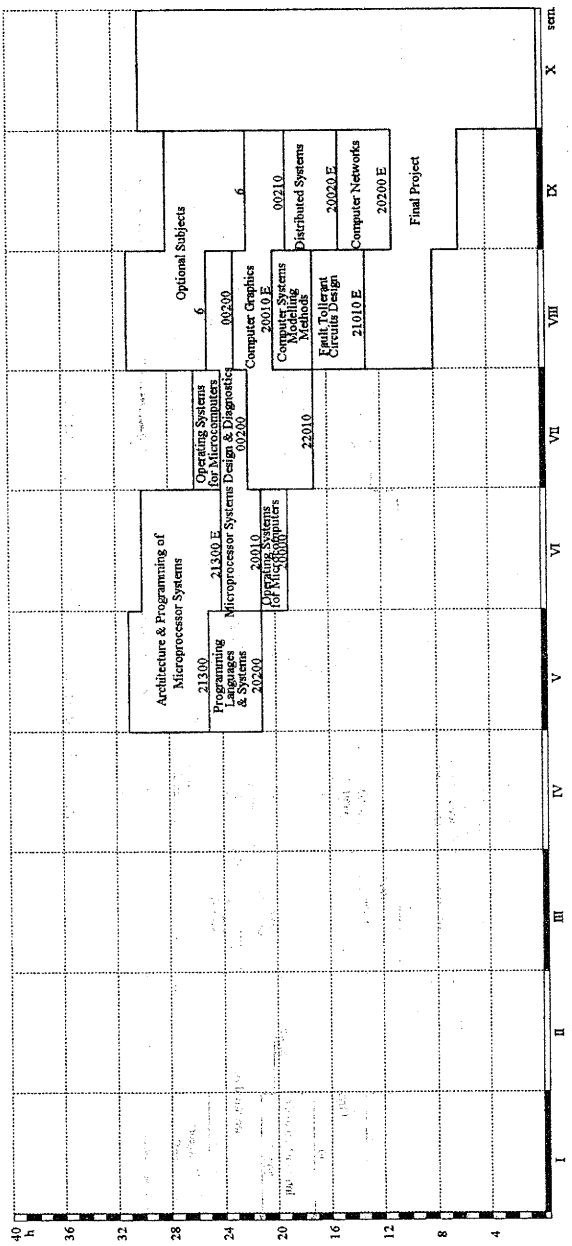

Fig. 4. Old version of the Microprocessor and Microcomputer Systems course curriculum.

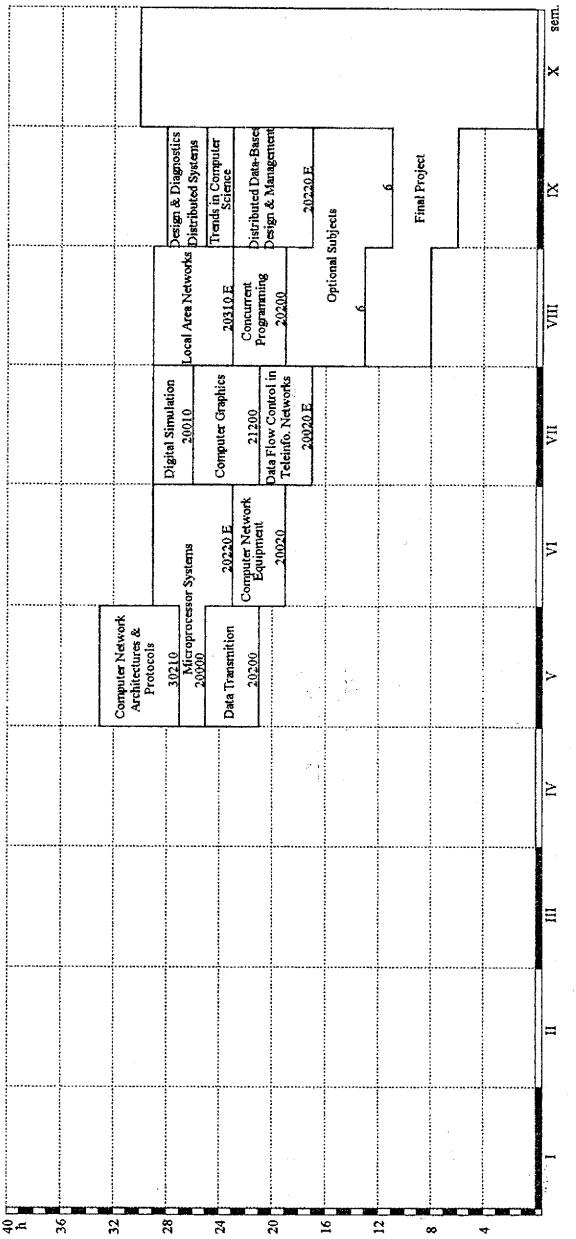

Fig. 5. Old version of the Computer Systems and Networks course curriculum.

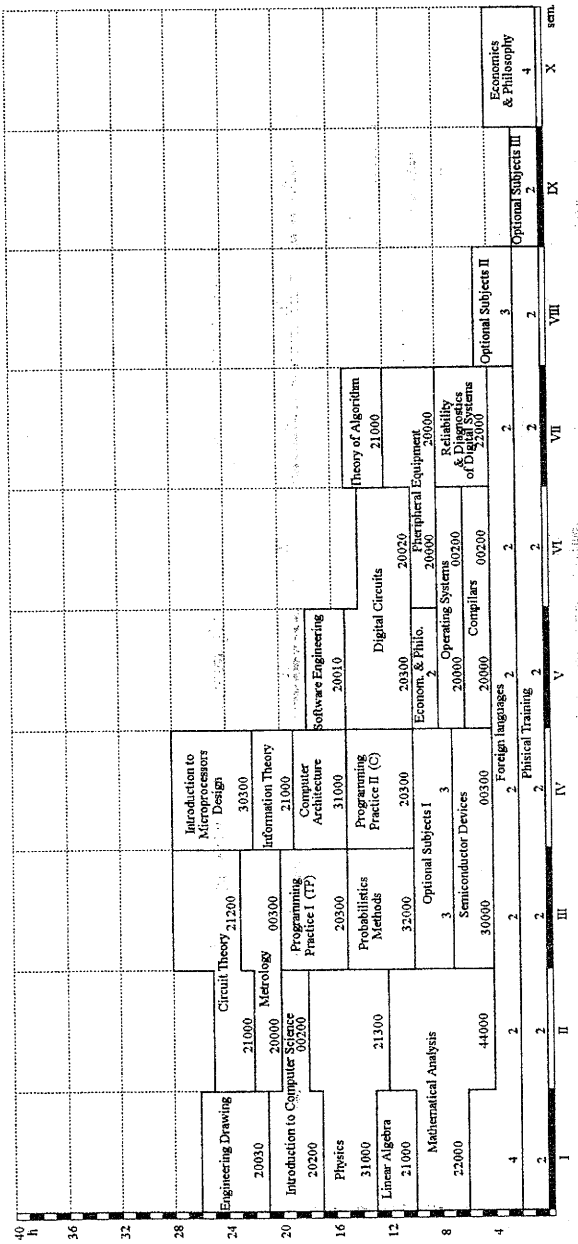

Fig. 6. Revised basic course curriculum.

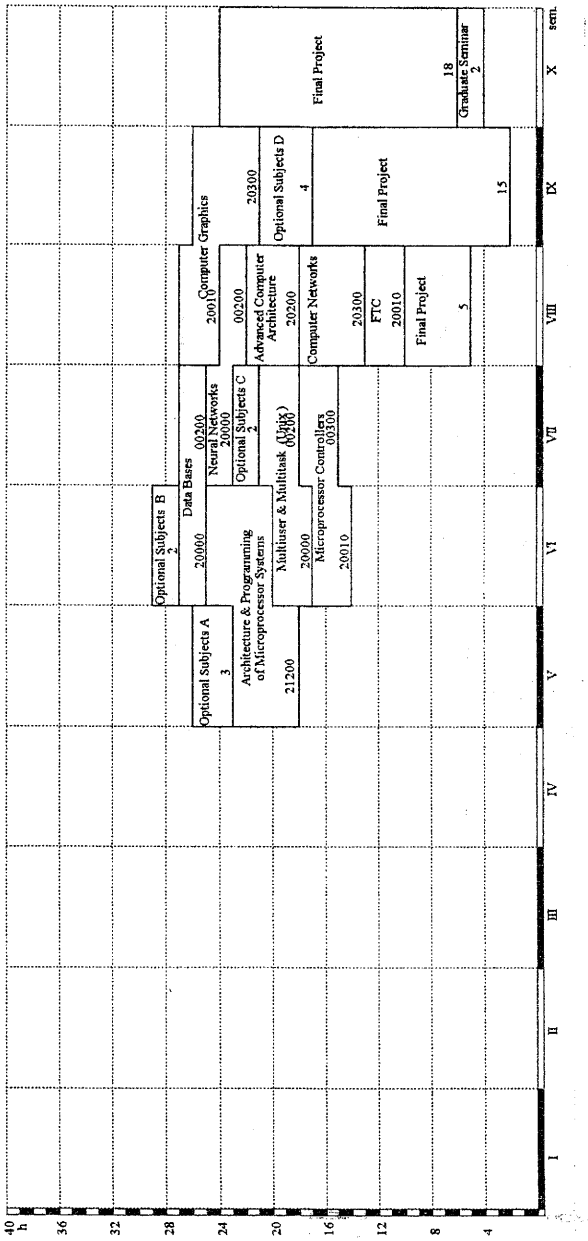

Fig. 7. Revised Microprocessor and Microcomputer Systems course curriculum.

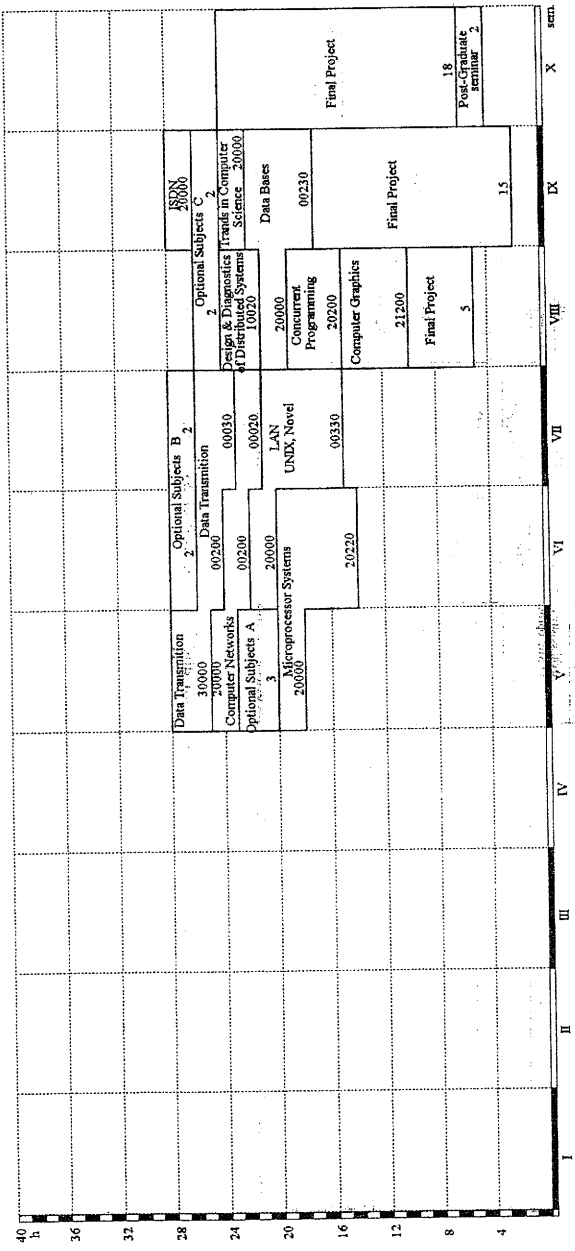

Fig. 8. Revised Computer Systems and Networks course curriculum.