# WOMEN AND THEIR STUDIES OF ELECTRICAL ENGINEERING

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***Contents:*** This study discusses the problems concerning the position of women on their studies of electrical engineering and in their further professional life. The participation of the feminine gender on faculties of electrical engineering has been analysed and on the basis of several indices their average success on studies compared to the students of the male gender has been evaluated. The status of women - B.S. in electrical engineering - has also been explained and particularly in regard to their position in the native surroundings.

## 1. INTRODUCTION

The question of equality of genders in the technical field was initiated some time ago, and recently the activities on this level are becoming more and more intensive all over the world. Within the world association of engineers in the field of electrical engineering and electronics IEEE, a special association under the name of WIE (Women in Engineering) has been founded (1) with the major aim to improve the professional status of women in the engineering, scientific and research activities. The society includes numerous activities such as: obtaining, exchange and publication of information on the position of women engineers, the realization of various educational programmes and similar.

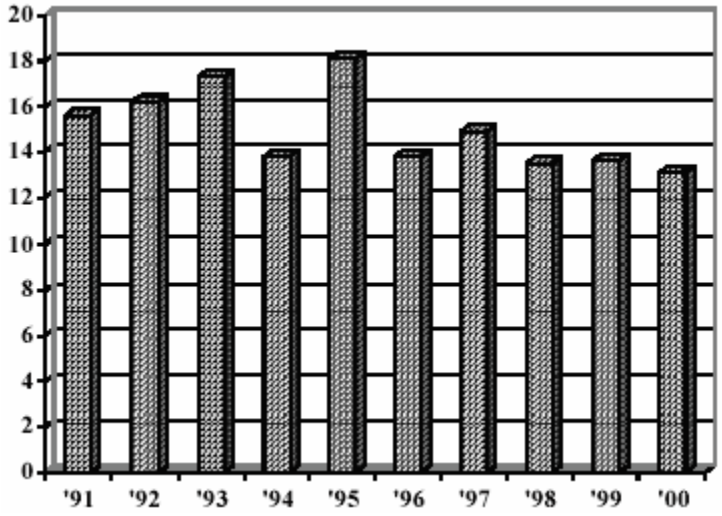
Especially in the field of telecommunications, significant efforts are being made on this plan. Within the Union of Telecommunications (ITU) from Geneva, in 1998 a special body was founded to deal with problems of the equality of genders under the name of TFGI (Task Force on Gender Issues) (2). The main goals of the working groups of this institution are the promotion and stimulation of equality of genders in telecommunications, to provide for positive influence of the development of telecommunications on the position of women etc. One of the first activities of ITU TFGI Working Team in our country was a recently held panel discussion under the name «Women and Telecommunications» (3) and within it the problems concerning the position of women in the field of telecommunications in Yugoslavia, the question of genders on High-school institutions in the field of electrical engineering, the importance of telecommunications for the improvement of the women's lives etc. have been stressed.

This study whose contents have partly been presented on the a.m. panel discussion, will first of all discuss the question of the status of the female gender on the studies of electrical engineering seen from the angle of the author who personally and professionally is also bound up with the university environment. After the introduction, two chapters will be dedicated to the questions of the determination of women to study electrical engineering, the participation of female students during enrollment, the success during studies and similar. The chapter that follows after that will be an attempt to perceive in general the status of women in the engineering profession.

Finally should be mentioned that the statistical facts presented in this work, considering that they have been done on a relatively small specimen, should be understood first of all as an illustration i.e. indicator of certain facts and appearances relevant for the equality of genders.

## 2. PARTICIPATION OF THE FEMALE GENDER ON THE STUDIES OF ELECTRICAL ENGINEERING

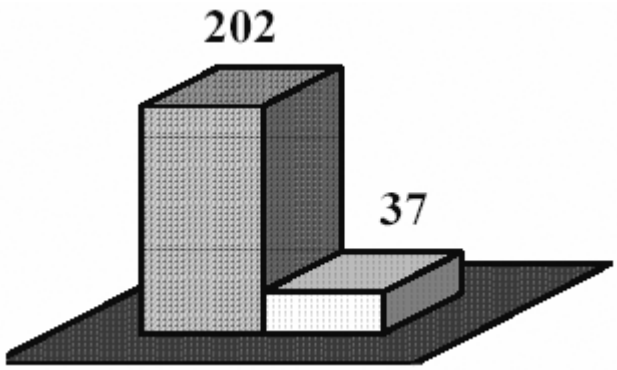
Even without any exact quantitative indicators, it is evident that the feminine gender gets enrolled at the studies of electrical engineering in a considerably less percent. There are no big differences between the faculties of electrical engineering within FRY and the situation is similar in the world, too. An illustrative example may be the facts presented from the previous decade about the percentage of enrolled girls on regular studies at the Faculty of Electronics in Niš in regard to the total number of enrolled students that are shown on the graph of Picture 1. The calculated average proportional participation of women at enrollment during the mentioned period amounts to exactly 15%.




**Picture 1.** The proportional participation of the feminine gender among the enrolled students of the Faculty of Electronics in Niš in the period from 1991 to 2000.

Let's also discuss the latest information on the admitted candidates on the Faculty of Electronics in Niš in the first registration period that was done in July 2001 (Picture 2). Out of 239 students that enrolled in the 2001/2002 academic session in this period, only 37

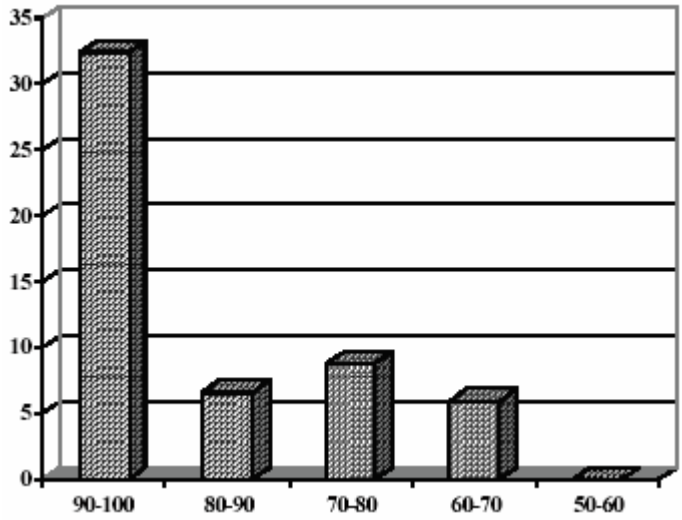
were girls which makes 15,5% - it's a fact that completely fits into the previously presented picture.




**Picture 2.** The number of male (202) and female (37) candidates enrolled at the Faculty of Electronics in Niš, in July 2001

Deciding what programme to take when the latest generation of students of the Faculty of Electronics got enrolled, most girls chose the programme of Computer Engineering and Information systems (18 girls or 48,6%) and the programme of Telecommunications (14 girls or 37,8%). Two girls gave priority to the programme of Electronics and another two girls to Industrial Energetics. One chose Microelectronics and none the programme of Automatics. Because of the fixed number of available places per programmes, 5 female candidates from the lower part of the rank order were re-directed, so that the final disposition of female candidates according to the programmes is more even.

It is also interesting to examine the success of the female gender in the mentioned registration period in regard to the male gender, with the total maximum point number 100, where the success from the secondary school participates with 40 points and the results of the entrance examination in mathematics and physics amount up to 30 points each. The proportional share of the female gender is higher in the upper part of the rank list. The diagram on Picture 3 shows the proportion of girls concerning the total number of candidates that won the points in the mentioned ranges. Especially should be pointed out that in the category of candidates that won between 95 and 100, out of 43 candidates 17 are female which amounts to 39,5%. The average of the won points for all enrolled male candidates is 76,56 and for women 84,96.




**Picture 3.** Proportional participation of women among candidates with a number of points within the mentioned range

The statistical data on the proportionally low number of girls that got enrolled on these studies are very similar concerning other faculties of electrical engineering in our country as it could be heard on the mentioned panel discussion. The fact that the percent of enrolled girls at the faculties of electrical engineering in the USA ranges app. to 14% (1) testifies that the situation in our country doesn't differ much of the one in the developed countries.

Why relatively few women decide to study at the faculty of electrical engineering? Though it seems on first sight that the less determination of girls for traditionally «male» faculties is understood by itself, the essential answer to this question is not simple and it reaches into other scientific fields such as sociology, psychology and similar, that are not a part of the author's profession. Therefore, and without aspiring to analyse this problem completely, here we may mention some observations that are connected with this mentioned problem.

When it comes to the difference between genders concerning professional decision, contemporary posychology very often points out the influence of the parents and the social surroundings that, disregarding the shown individual bents, forces children on traditional models of behaviour and specialization. The choice of toys for girls will mostly be intended for the development of the emotional sphere, artistic bents, care for other persons or their devotion to home. On the other side, in most cases boys will be offered toys of a technical type or the ones that direct towards logical reasoning.

Though primary and secondary education create at first sight completely equal conditions for boys and girls to develop specific potentials and bents, anyway, it is evident that somehow in this period a positive or negative judgement about future technical professions is formed. The relation to studies of electrical engineering is not in a complete correlation with the capabilities of the female part of the population for these studies. Facts about the approximately equal successfulness on contests of pupils of primary and secondary schools in the mentioned subjects testify that the genders start with almost equal potentials concerning mathematics or physics. Recently an interesting research result was presented on the global level (UNESCO), that in the earlier school years (primary school) girls are

somewhat better and more successful than boys on contests in mathematics, and not until the later school years (secondary school) the successfulness moves towards the male gender.

It's a fact that somehow in the period of the development of their personalities before enrolling on faculties, an unevenness in genders occurs when it comes to the choice of technical studies. The impression of the author is that secondary school pupils influenced by various factors form such a way of thinking. It is interesting to examine, for example, the relation of boys and girls to computers in our environment. Some simple observations of one female high school pupil testify about it:

«Much more boys then girls have a computer at home. If the parents because of their profession do not need a computer, they more often decide to buy it to a male than to a female child».

«Its no wonder that boys adore computers when almost all the games are made for them: football, car races, martial and war games and similar».

The same pupil observes that on lessons of Information Systems «boys are more ready to experiment with computer and are not afraid of the possibility to ruin something while girls are much more cautious» (probably a result of the upbringing from an earlier period).

The mentioned observations are probably only a small part of the complex reasons why on every six boys just one girl decides to study electrical engineering. Certainly a significant moment in the choice of faculties besides personal aptitudes are also the social and cultural milieu that forces girls on their coming large and responsible role in the family. There is also a lack of self-confidence. Demanding faculties like electrical engineering, that concerning the enormously rapid development in this field requires constant learning and advanced training later, may arouse fear if it's possible to harmonize the professional with the family obligations.

## 3. THE SUCCESSFULNESS OF WOMEN ON THEIR STUDIES OF ELECTRICAL ENGINEERING

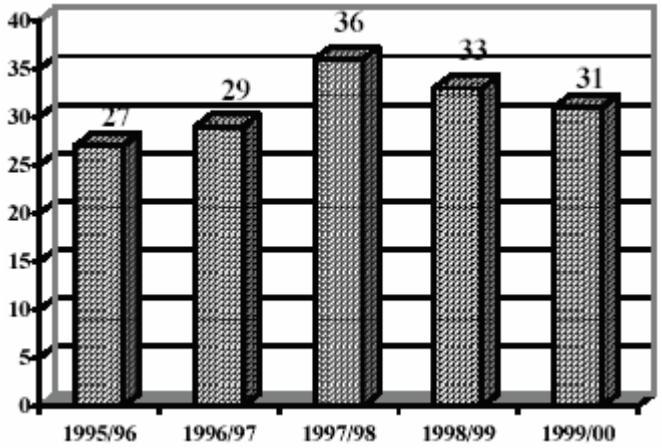
It is interesting to revert to statistics in order to examine how successful women are on their studies of electrical engineering. Table 1 shows the percentage of female advanced university students (who satisfied all course requirements) of the total number of advanced university students for the period from the 1992/1993 till 1999/2000 academic session. Because of the approximate comparison the same table shows the percentage of girls of the same generation during enrollment – that means 5 years earlier. It may be noticed that in every generation the proportional share of women among advanced university students is higher than among freshmen.

**Table 1.** Comparison of the participation of female students of the same generation at enrollment and when they become advanced university students

| Academic session | Percentage of female graduates | Percentage of women at enrollment 5 years earlier |
|---|---|---|
| 1992/93 | 31,5 % | 26,7 % |
| 1993/94 | 23,6 % | 18,7 % |
| 1994/95 | 33,7 % | 24,2 % |
| 1995/96 | 22,8 % | 19,1 % |
| 1996/97 | 23,6 % | 15,6 % |
| 1997/98 | 25,1 % | 16,2 % |
| 1998/99 | 18,1 % | 17,3 % |
| 1999/2000 | 15,2 % | 13,8 % |

The examination of the number of women among students with the highest average marks during their studies shows an even more favourable picture for the female gender.

Just for tration, on Picture 4 you may see the percentage of the female gender among the awarded students of the Faculty of Electronics in Niš in the period from 1995-1999 (4). One third of the best students are women which is a very high percent in regard to the one sixth or one seventh at enrollment.




**Picture 4.** The proportional participation of women among the awarded students of the Faculty of Electronics

The example of the generation that was enrolled on the Faculty of Electronics in Niš in 1975 testifies that the successfulness of the female gender on their studies of electrical engineering is not only related to the newest generations of students. The proportion of women and men at the enrollment was 16% and 84%, respectively. On their way to the diploma that proportion was changed towards 24% and 76%. If the percent of graduated students is observed especially according to genders, the following result is obtained:

26,3% of the number of the enrolled male students graduated with the average mark 7,08. 40% of the number of the enrolled female students graduated with the average mark 7,36. Eventually, more girls were among students with the highest average mark: the average mark between 8 and 10 was achieved by 3 female and 2 male students.

A similar conclusion concerning the successfulness of women on their studies of electrical engineering on other faculties of electrical engineering in the country could be heard on the previously mentioned panel discussion.

The facts concerning the somewhat better successfulness of female students may in the author's opinion, be correlated with a very probable occurrence, that girls who have chosen electrical engineering start in average with a somewhat better success and capabilities. They, however, for sure show a clear determination for the chosen profession as well as a firm decision to reach the target.

## 4. THE PROFESSIONAL CAREER OF WOMEN – B.S. OF ELECTRICAL ENGINEERING

After we have examined the participation and successfulness of the female gender on various faculties of electrical engineering it is logical to take concern of their later professional career. A detailed analysis of the status of women - B.S. of electrical engineering in our country and abroad would require a lot of official statistical data which cannot be obtained easily. Therefore we shall only discuss the situation on this plan. According to the facts that were at the author's disposal concerning the position of women – B.S. of electrical engineering, the following observations may be stated:

The proportion of women engineers working in unmanufacturing activities is larger than in the manufacturing ones. A typical example is education. For instance, the previously mentioned generation who reached the level "advanced university student" (that are students who satisfied all course requirements) two decades ago, two thirds of the total number of engineers working in education are women and only one third are men.

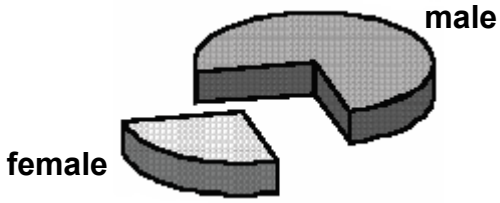
Let's have a look at a faculty institution. Table 2 shows the distribution according to genders among the teaching staff of the Faculty of Electronics in Niš (state from June 2001).

**Table 2.** The participation of women on the Faculty of Electronics in Niš

| Title | The proportional participation of women |
|---|---|
| Full professor | 16,2 % |
| Associate professor | 23,8 % |
| Assistant professor | 17,6 % |
| Teaching assistant | 31,1 % |
| Beginning assistent | 37,1 % |

It may be noticed from table 2 that the structure of genders is distinctly better in the categories of teaching assistents and assistants beginners which looks very optimistic and encouraging concerning the conditions for equality of genders. Observing all categories the total number of women in the teaching staff is 26,45% (Picture 5) which on the whole is very satisfying.

Observing the individual departments of the Faculty of Electronics in Niš the situation concerning the participation of women in them differs, but the fact that on the department for telecommunications out of 23 teachers and associates 10, i.e. 43,5% are female which is the highest percent of the participation of women compared to other departments should be stressed as an affirmative fact.




**Picture 5.** The proportional participation of genders among teaching staff at the Faculty of Electronics

However, women are represented neither in the leading team of the Faculty of Electronics in Niš (the dean and 3 vice deans) nor among the 10 department heads! In the history of the Faculty of Electrical Engineering in Belgrade all 16 deans were men (3). It is similar on other faculties of Electrical Engineering.

In the manufacturing activities the proportion of male engineers is somewhat higher. However, concerning the actual difficulties that in recent years large production enterprises have been going through, the author's impression is that male engineers get a new jobs in an easier way. It is obvious that there are very few women engineers among owners of private firms in the field of electrical engineering/electronics in the region of Niš. It is also very indicative that there are very few women-engineers employed at private firms.

Generally, women get their jobs in a more difficult way. According to the data of the Employment Bureau in Niš from May 2001, approximately one third of the total number of graduated engineers of electrical engineering without employment are women which is a higher percent in relation to the percent of the graduated female colleagues.

In order to draw reliable conclusions about the participation of women engineers in the field of telecommunications, it is necessary to research more extensively. Here we may give only a few examples. For instance, the proportion between men and women among the engineering staff in one working unit of *Telekom* in Niš is 23 to 12, which gives a very satisfactory result of 34%. However, the percentage of women engineers on leading positions is significantly lower. Concerning several research institutes working in the field of telecomunication, we get a somewhat unfavourable picture concerning equal participation of genders, especially when it comes to the leading positions.

*Ericsson* is one of the first companies in the world in the field of telecommunications that started the initiative and activities regarding equality of genders. Environments that noticed the importance of equality of genders for the professional development are being recognized, stimulated and awarded through special actions. The experience of this company in its efforts to secure a more even proportion of genders and entrusting responsible leading positions to women is very satisfactory. This experience is in accordance with the the results of numerous researches that show that women are usually loyal to their firms, they work hard and persistently, and are often more productive and creative than their colleagues.

Unfortunately, examples of real concern for equality of genders are still very rare. What exists on paper is hard to be achieved in reality, especially when you bear in mind the traditional role of women in their families. A high level of social protection of women that understands relatively longlasting leaves because of raising the children certainly is one of the reasons why employers make discriminations when they decide to employ someone. Longer leaves from work may also mean that they get out of step with the others when following the innoviations and this is especially related to women engineers in the field of modern technologies. The large burden of home and family duties has a negative influence on the professional career of a woman, especially in our conditions of living – conditions of insufficient family budget and poor organization of services and activities that should make the daily life easier. We should also add the stereotype way of thinking where there is no place for a woman that is ranked high on the scale of professional success, a woman manager or a director. Therefore it is not surprizing especially in the technical world, why managers are usually men while women are deputies, assistants, councelors or executives. Disregarding the proclaimed equality, the fact is that in practice where power and influence are bigger, the participation of women is less.

## 5. CONCLUSION

The participation of the female gender is outstandingly lower on the studies of electrical engineering, which for sure is not proportional with the real potentials and bents of this part of population. However, concerning the successfulness of graduating and studying, women do not lag behind, they even achieve proportionally better results. The status of women engineers of electrical engineering in our conditions is not satisfying. In comparison to male engineers they get employed in a more difficult way, they are proportionally less represented on better paid working positions and at least on leading positions.

Which steps could be made in order to get closer to the real equality of genders in the professional sphere?

The already existing general paragraphs concerning the equality of genders in the field of legal regulations could be supplemented by more concrete regulations that would improve the professional status of women. For example, it would not be excessive to add the explicite regulation into the Law of Labour that for the same kind of jobs women must not be paid less then their male colleagues. The regulation about the so called positive discrimination that prescribes that if the applicants for a job or promotion satisfy the same requirements, the priority must be given to the gender that is less represented, could also be included in the Law.

Besides, the development of technology that would help women in the organization of the business field should be used to a great extend. For example, new technologies will open the possibility to work with atypical working hours and from home, or it will give the possibility of permanent education of women and her connection with the firm during her leave from work. It is completely certain that the very expansive development of telecommunications today may help women to harmonize their professional life with the role in the family as much as possible. Women engineers of telecommunications that work on such development projects may contribute in the best way to the problem of women's rights.

***Literature:***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