

BIOMEDICAL ENGINEERING EDUCATION AND JOB PROSPECTS IN INDIA

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Abstract

Despite the fact that many Engineering Institutions in India are planning to start undergraduate courses in Biomedical engineering and even the number of students seeking these courses is on the rise, the existing Biomedical engineering (BME) graduates in India are finding it tough to find a placement in the job market. In order to analyse the reasons leading to this situation, a survey is being conducted. The preliminary results of the survey indicate that there exists a gap between the undergraduate BME syllabi of various universities and the needs of the industry: certain subjects of the current curricula are irrelevant to the Indian industries, there is a need to include other relevant subjects and further, the laboratory sessions are inadequate. Most of the respondents feel that electronics engineers are preferred to Biomedical engineers by the Biomedical firms due to the fact that the Biomedical engineers' knowledge of electronics is inadequate. This paper presents the preliminary outcome of the survey thus being conducted and focuses on the need for revision /modification of the syllabi.

I Introduction

Biomedical engineering (BME) education in India is still in its infancy. Several Engineering Institutions in India have been offering B. E. (BME) courses for the past few years and a few batches of students have been conferred degrees. As the number of students seeking to enroll into this program is continuously increasing, many more institutions are planning to start this undergraduate course.

The job scenario for the existing Biomedical engineers is discouraging, as presently many of

the Bio-Medical firms in India prefer electrical, electronics or computer science graduates to Bio-Medical graduates. As a result of this, a BME graduate is either unemployed or forced to continue further studies in the field or change the field to secure a job. Even the software industry that is recruiting graduates of other allied branches of Electrical engineering is not considering Biomedical engineers in the campus recruitment. This indicates that there exists a wide gap between the needs of the industries and the undergraduate BME curriculum. In order to reduce the gap and make the curriculum industry oriented, the undergraduate curriculum needs to be modified by deleting the subjects that are found irrelevant and obsolete and incorporating relevant state of the art subjects.

The curriculum modification of an undergraduate course, particularly for an interdisciplinary program like Biomedical engineering is undoubtedly a complex task. Some of the students will be planning on academic careers, while others will be looking forward to industrial careers and during the process of curriculum planning, due importance needs to be given to both. For the effective modification of the curriculum, the need was felt for a survey to predict and second-guess the subjects that would be of value to the undergraduate students. Accordingly, a survey is being conducted by giving Questionnaires to biomedical engineering graduates as well as engineers working in the Biomedical companies. [1] influenced some of the questions that went into the questionnaire.

This paper aims at discussing the various problems pertaining to the current biomedical engineering curricula. In this connection, some of the reputed Bio-Medical firms are consulted to get their feedback. The survey also looked into the possibility of extending the course duration

to 5 years, to enable the students to acquire a thorough understanding of the subjects and equip them adequately for the requirements of the industry.

II Survey

The basic aim of the survey is to identify the subjects that are of value to the Biomedical engineers. Towards this end, Undergraduates, Postgraduates and Doctorates in the field of Biomedical engineering are being consulted to obtain their views. To facilitate the analysis of the responses, they are divided into five major categories, each of which is further divided into appropriate subcategories as given below:

1. B.E. (Biomedical Engg /Medical Electronics)
2. M.E. (Biomedical Engg /Medical Electronics)
3. Ph.D. (Biomedical Engg)
each of the above 3 being subcategorized as
 - a. Searching for a job.
 - b. Working for a Biomedical firm
 - c. Working for a non-Biomedical firm.
 - d. Working as a Teaching faculty.
4. B.E, M.E, Ph.D. (non-Biomedical Engg)
working for a Biomedical firm.
5. Currently enrolled students of
 - a. B.E. (Biomedical / Medical Electronics)
 - b. M.E. (Biomedical / Medical Electronics)
 - c. Ph.D. (Biomedical Engg)

In each sub-category, on an average, 12-15 questions are being asked to find out, their academic performance, their perceptions of the Biomedical program, their view about the difficulty in getting a Biomedical job and the subjects of importance for the future. Responses are taken even from non-Biomedical graduates who are working for the Biomedical engineering companies. For the current presentation, responses could not be obtained from category 5.

III Demographics of responders

A part of the Undergraduates who responded are from Bangalore University and the rest are from Cochin University. Efforts are already on to

obtain responses from other University graduates too. Of the Biomedical engineering graduates responded, 9 are searching for a job, 4 are working for Biomedical firms, 4 are working in hospitals and 5 are working for non-Biomedical firms. 12 more, who are searching for jobs, are yet to return the forms. Though the sample size till now is too small to draw generalizations, it is observed that, irrespective of the category, qualification, job status, etc., they more or less concur on some of the key issues.

IV Responses

Is there a gap between the needs of the Biomedical Industry and the Biomedical curriculum ?

Of the 33 respondents for this Question, 26 feel that a gap does exist. These include respondents of categories 1a, 1b, 1c, 2b, 2d and 3d. The remaining 8 have not commented. Of the 26, more than 75% feel that the gap can be reduced by adding to the curriculum, some more courses on electronics (both theory and labs). About 25% feel that adding computer related subjects to the curriculum will also make the syllabi industry oriented.

What are the areas of Biomedical Engineering which are growing in importance ?

This question was asked to determine the job areas of the future. Of the 26 who have answered, 19 feel that Image Processing is the area of significance for the future. These include respondents of categories 1b, 2d, 2b and 3d. Almost an equal number feel that it is Signal Processing, while 6 others feel that it is Instrumentation and Monitoring. These responses indicate the need to include subjects related to the above areas in the curriculum.

Is it difficult to get jobs in the BME field?

The questionnaire asked the respondents to grade their opinion into the following categories: 1. Very easy, 2. Easy, 3. Not easy, 4. Very difficult and 5. near Impossible. Of the 32 who responded, only 2 feel that it is easy, 15 feel that it is not easy, 11 feel that it is very difficult and 4 specifically mentioned that it is *highly*

impossible. This is a clear reflection on the existing job scenario for biomedical graduates.

Is non-Biomedical degree a handicap to work in the Biomedical engineering field?

This question was asked of only non-biomedical engineers working in Biomedical industries, to ascertain whether they are finding it difficult to cope up with their job. Of the seven who have answered this, 5 say NO, 1 says YES and 1 has not commented. This indicates that a non-Biomedical engineering graduate is equally comfortable as a BME graduate in the BME industry.

Comment on a new B. E. (Electronics & Biomedical) program spread over Ten semesters (like the B.E. - Architecture course), which is similar in syllabus to B. E. (Electronics & Communication). A student of this proposed program studies Biomedical subjects instead of communication subjects in the first eight semesters. The ninth semester will contain exclusively Medicine and applied medicine related subjects. The tenth semester will be for the Project work / Hospital training (Internship) / Industrial training for Six months.

This question was aimed at knowing whether the present duration of 4 years of undergraduate program is to be extended to give a proper exposure to the subjects. Of the 26 who have responded, only 5 agree for this, 7 disagree with this, 9 have not commented, *whereas 5 have suggested that the Biomedical program at Undergraduate level needs to be discontinued!*

In the existing syllabus, what subjects are to be discontinued?

Though the different Universities have different syllabi, this question was asked so that the responses can serve as a guideline to those who want to embark on the task of revision of the syllabi. Of the 18 Bangalore University graduates, 8 feel that it is Simulation & Modeling, 12 feel that it is Fields, Lines & Waves and 2 feel that it is Life sciences. Of the 7 Cochin University students, 5 feel that it is Biomaterials, 4 feel that it is Biomechanics and Biomedical transport phenomena, while 3 feel that it is Thermodynamics.

V Conclusions

Survey results indicate the following. The main reason for the fact that the Biomedical Engineering graduates are finding it difficult to get jobs, is that their undergraduate curriculum is not oriented sufficiently towards Electronics. This can be overcome by including some more Electronics subjects (both theory and labs) into the curriculum. Making the Industrial training compulsory can reduce the existing gap between the needs of the industry and the curriculum.

References

1. Richard A. Normann, Bioengineering Spotlight, *Update from the University of Utah*, Autumn 1996.