

# BIOMEDICAL ENGINEERING: CURRENT STATUS AND ISSUES FOR DEVELOPMENTS IN INDIA

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## ABSTRACT

Biomedical engineering is an important field of engineering science that plays pivotal role in the modern health care systems. Rapid developments in medical technology has boosted the medicare system to a large extent. These developments greatly improved the quality, availability and efficiency of the health care delivery system. Technological advancement in the developed countries contributed their advancement in developing countries to certain extent. In countries like Indian these technological advancements can be beneficial only in the shorter period. It is rather impossible to visualize these benefits in the long term unless otherwise plan are devised to sustain these developments. therefore, it is high time to start more biomedical engineering programs in the country. In this regard various technical and medical bodies must unit and cooperate in the proper molding of programs. Different biomedical societies and related organizations can play a greater role in the curriculum development. These organizations must contribute their efforts in designing course, projects, set short and long term goals. Also create an environment to establish active interactions with various institutions of interest. Initially plans should be drawn to modify the existing curricula by introducing new and need based programs. Also provide expertise to the institutes starting new biomedical engineering under graduate, post graduate and research programs. This paper outlines some of these issues related to the development and modernization of biomedical engineering programs in India and other developing countries.

**Keywords:** Biomedical Engineering, Education, Curriculum.

## INTRODUCTION

Biomedical engineering is a specialized branch of engineering plays greater role in the modern medical world that deals with health, comforts and health related activities. In a broad definition biomedical engineering can be stated as "the application of engineering methods and technology to the problems in biology and medicine". Specifically, engineering concepts are applied to improve the understanding of the biological systems, develop instrumentation, new materials for the diagnostics and

therapeutic purposes, improve the life support systems and enhance the quality of handicapped and disabled persons [1].

### *Branches and Functions*

Biomedical engineering is broadly classified as bioengineering, medical engineering, clinical engineering and rehabilitation engineering. Bioengineering deals with the findings and analysis of functioning and fundamental aspects of living systems. Medical engineering deals with design and testing of new concepts and develop new device or instruments. Clinical engineering directly deals with patients and other health care professionals of clinical and laboratory setup to provide better patient care at minimum cost. Rehabilitation engineering address problems persisting after therapy which nominally unsuccessful or impossible to certain difficulties [1].

### *Biomedical Engineering Curriculum*

Biomedical education is a developed concept in the industrialized countries, because of the well structural curriculum and rapid advancements in medical technology [2]. In developing countries like India the programs exists only in the top institutions and are yet to make an impact in the society. In contrary the import of advanced medical instruments has been increased many folds in the recent years without having technical support to maintain, service and employ effectively. It is rather difficult to live long with borrowed technology unless efforts are taken to develop an indigenous technology. This is highly essential in the globalization of economy to strengthen our economy as well as to reduce the medical cost in the longer run [3]. This can be best achieved by creating more and strong curriculum. Biomedical curriculum must have a core engineering course to provide a basic knowledge and selected engineering courses to impact their application to medical sciences. Courses must be designed to provide solid background and impart skills that allow them to interface engineering with medicine.

### *The main objective of biomedical engineering education*

- 1) Provide training to engineering to obtain middle level position in industry in design, manufacturing, sales and service of biomedical equipments or to take up position in a medium size hospitals

- 2) Prepare to join research and begin career in the academics and research.
- 3) Be a biomedical engineering consultant to involve widely in biomedical related activities.

All these activities are to provide a continuing and lifelong professional development in the biomedical field. Biomedical curriculum must be designed such a manner to be beneficial to students, university, hospital, Industry and in large to the society as a whole.

The extent the biomedical engineers accepted by both the hospital and industry depends on the quality of education, training and performance. Apart from these the efforts must come from the students to make their career acceptable to everyone. In the modern medical technology the innovative approach is highly essential. Therefore, the emphasis are to be given more to students to suggests newer problems and profits to their interest. Apart from inter disciplinary involvement in the research medical and engineering students are encouraged to work on a common research problems.

#### *Review of Biomedical Engineering Programs*

The need for biomedical engineering has been realized in 1950's in USA and today there are more than hundred universities offers programs from under graduate to advance research levels. In addition, more than seventy five institutes offer certificate, diploma and associate degrees (vocational) courses and different specialized training. In India biomedical engineering was introduced in early 1970's and today we have only few institutes and universities offer programs. Few polytechnic offers elective courses in medical electronics and some offer specialized branch in rehabilitation engineering. Still we yet to attempt for a diploma course in biomedical engineering. At under graduate level we have three or four universities offer programs and all are totally biased towards bioelectronics. All IIT's, IISc, Bangalore and Anna University, Madras offer master programs in biomedical engineering. Here also the programs are more biased towards electronics and certain extend all the branches of biomedical engineering. Since they offer few seats for research, their impact on the society is not realized. Moreover, these advanced research train them to be in-line with international need and most migrate to the west. There are quite a number of central institutes like CSIR and medical research institutes like Chitra Tirunal Biomedical Research perform challenging work and research. But unfortunately there is no coordination between these institutes with educational centers and industries. We need to have a combined effort to achieve our goals in biomedical technology. In the recent times developing countries like china streamlined their biomedical programs [4].

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#### *Few points for development of programs*

1. Set an objective oriented biomedical programs based on the existing and need based programs.
2. Flexibility in the selection of courses and research problems.
3. Initiate and encourage inter departmental projects and research involvements.
4. Create an environment to establish active interactions from various institutions, in terms to resources sharing, project and research.
5. Establish interactions with medical professional in sharing to expertise and project developments.

#### *Role of biomedical societies and related organizations*

1. Provide expertise and guidelines for starting new biomedical programs. Specifically, design courses, projects, set short and long term goals.
2. Modify and modernize existing curriculum by introducing new concepts.
3. Provide training to the existing faculties to new areas and train faculties from other branch of engineering to teach and start research in biomedical engineering.
4. Routine assessment of biomedical programs at regular intervals.
5. Establish centers of excellence in various branches at different institutions.
6. Establish active interaction between institution-industry-hospital.
7. Coordinate and cooperate in establishing collaboration with institutions in advanced countries.
8. Network and document various biomedical activities in the country.
9. Get experts from different countries on regular basis.
10. Establish a national biomedical center in the country in line with CSIR laboratories to provide job opportunity to young engineers to continue their goal in biomedical program.
11. Make use of the economic liberation to develop computer based medical technology to find the viability for export oriented activities.

These are some of the essential aspects of activities to be incorporated at the earliest in India and in other developing countries.

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