

## EDUCATION OF MEDICAL PHYSICS AND BIOMEDICAL ENGINEERING AT GONO UNIVERSITY IN BANGLADESH

Azhari H. A.<sup>1</sup>, Zakaria G. A.<sup>1,2</sup>, Hartmann G. H.<sup>3</sup>

<sup>1</sup>Department of Medical Physics and Biomedical Engineering, Gono University, Dhaka, Bangladesh

<sup>2</sup>Department of Medical Radiation Physics, Gummersbach Academic Teaching Hospital, University of Cologne, Germany

<sup>3</sup>Dept. of Medical Physics in Radiotherapy, German Cancer Research Center (DKFZ), Heidelberg, Germany

**Abstract** – Medical Physicist personnel is an integral part of cancer treatment. In Bangladesh Medical Physics and Biomedical Engineering education first started in the nineties. In 2000 a fullfledged “Department of Medical Physics and Biomedical Engineering” (MPBME) was founded at Gono Bishwabidyalay (a private university in Savar, Dhaka). Till now Gono University is one and only university offering this course in Bangladesh. In this paper achievement of quality of the education in MPBME is elaborately discussed. The department is continuously pursuing a high quality in education in all aspects like course curriculum, teaching methods, local and international collaboration, research, practical class. As a result the establishment of Medical Physics and Biomedical Engineering Education in Gono Bishwabidyalay (University) is a success story for Bangladesh. We would like to continuously develop strong and advanced Medical Physics and Biomedical Engineering Programs for education and research by incorporating the latest developments of Imaging and Radiotherapy in future.

**Keywords** – Medical Physics, Biomedical Engineering, Education, Quality, Gono Bishwabidyalay (university).

### I. INTRODUCTION

Higher education in general refers to learning that occurs at universities, academies, colleges, seminaries, or institutes of technology. In that sense, the Gono University in Bangladesh offers higher education in various disciplines. In this paper, the higher education in Medical Physics and Biomedical Engineering at Gono University is specifically addressed. It is an example how a relatively recent discipline can be implemented and developed concerning quality issues in the country of Bangladesh. This study presents a picture of the quality enhancement achieved so far at Gono Bishwabidyalay (Gono University) in Bangladesh with respect to knowledge and competence at a local, national and international level. A variety of associated developments in quality management and institutional rules are particularly illustrated.

### II. HISTORY

The concept to establish higher education in Medical Physics and Biomedical Engineering in Bangladesh was started in the nineties. When Dr. Golam Abu Zakaria, Professor of Medical Physics, Germany, initiated this step by arranging several international seminaries on Medical Physics in Dhaka this subject was still quite a new subject in the country [1]. Following this, the need to implement such education in a more sustainable matter was discussed. The need was increasingly brought up by the fact that radiological techniques in diagnosis and therapy have undergone an enormous technical improvement and that an appropriate use of such techniques require a competent involvement of well educated medical physicists.

Finally the private university at Gono Bishwabidyalay headed by authorities with long-sightedness and prudence followed Dr. Zakaria’s suggestion to implement academic programs with an accreditation by the University Grant Commission (UGC): a Master Program (M. Sc in 4 semesters) in 2000 and a Bachelor Program (B. Sc in 8 semesters) in 2005, both on Medical Physics and Biomedical Engineering (MPBME). Until now Gono University is still the only university in Bangladesh offering B.Sc and M.Sc courses on that subjects. The department has presently a total of 145 students in both programs.

Gono University embedded in Gonoshasthaya Kendra (People’s Health Centre) at Savar near Dhaka offers a series of subjects for studying with a particular focus on aspects such as tradition, culture and creativity of the people of Bangladesh, the Liberation War of Bangladesh, Gender, Ethics and Environmental Science in order to equip students with the knowledge and skill necessary for becoming a complete human being both academically and psychologically. The University has own medical and medical related faculties. The Jahangirnagar Public University and the Bangladesh Atomic Energy Commission are located in close vicinity. Based on this environment Gono University is well able to cover the multidisciplinary aspects of Medical Physics. Thus the department can rely on the knowledge and experience of numerous teachers in medical physics and biomedical engineering as well as on access to different labor facilities.

Besides that and just from the beginning, a cooperation between the department MPBME and the University of Heidelberg, Germany including the German Cancer Research Center has been established in order to support the implementation of the department and to develop a students' educating program (in the right direction, who will have the sense of responsibility to run the department independently as well as work in hospitals according to European and international standards. Based on a grant of DAAD (German Academic Exchange Service) M. Sc students had the possibility to partly finish their practical part of thesis in Germany as part of this collaboration. In turn teachers from Germany overtook lessons in the department MPBME[2].

### III. COURSE CURRICULUM

The M. Sc course (120 credit hours) comprises four semesters of six months each. The core subjects of the syllabus are taught within the department. As it is a multidisciplinary subject, teachers are recruited from different disciplines as full time and part time basis. The course subjects are conducted by the related departments associated in the university like anatomy, physiology, biochemistry, medical ethics, mathematics and computational education etc. The practical classes are carried out in the laboratories of the department as well as, in radio-diagnostic and radiotherapy departments of collaborated hospitals.

Table-1: Syllabus of M. Sc in MPBME

1 <sup>st</sup> Semester 30 Credits	*T	**L	2 <sup>nd</sup> Semester 30 Credits	T	L	3 <sup>rd</sup> Semester 30 Credits	T	L	4 <sup>th</sup> Semester 30 Credits
Radiological Physics and Dosimetry	3	2	Conventional Planar Imaging	2	2	Magnetic Resonance Imaging	3	2	Thesis related course-5
Anatomy and Physiology	4	2	Digital X-Ray Imaging and CT	2	2	Nuclear Medicine	3	2	Thesis presentation-5
Biostatistics	2	2	Ultrasound Imaging	2	2	Radiation Oncology	3	2	Thesis work-20
Mathematics and Computational Skills	4	2	Brachytherapy	4	3	Radiation Treatment planning	3	3	
Professional Ethics-1	1	-	External Beam Radiotherapy	3	2	Techniques in Radiotherapy	3	2	
Radiation Biology	3	1	Radiation Therapy Devices	3	2	Radiation Protection	2	1	
Biomedical Electronics	2	1							
Semester viva voce	1	Semester viva voce	1	Semester viva voce	1				

\*T indicates the credit hours for theory course; one credit hour course is of minimum one hour lecture per week and \*\*L indicates the credit hours for Lab work; one credit hour is equal to 3 hours per week.

The following table- 1 shows the Syllabus of Master Course in Medical Physics and Biomedical Engineering in Gono University.

Universities under the leadership of the Chairman. Attendance, tutorial and midterm are accounted for assessment. The answer scripts are examined by the course teacher and by the external examiner. The scripts are re-examined by the 3<sup>rd</sup> examiner if they obtained marks differ more than 20% between internal and external examiner.

### IV. QUALITY DEVELOPMENT

The department is continuously pursuing a high quality in education as a standard in all aspects like in collaboration, teaching methods, research, or practical class. From the beginning, the syllabuses of the bachelor and master courses are based on available relative documents issued by the DGMP, AAPM or IAEA, which have been adapted to the need of Bangladesh. The course structure is designed to enable the students to work in hospitals, health institutes and research in MPBME. The basic prerequisite for the admission to master courses is a graduation degree in one of the following subjects: MPBME, physics, and related field in physical science or in bioscience, medicine or engineering disciplines.

The Department has three individual laboratories in spacious areas; Physics, Medical physics, Biomedical (lab) (Fig: 1). Within the country, the department has collaboration with National Institute of Cancer and Research Hospital (NICRH), Institute of Nuclear Medicine and Ultrasound, Dhaka Medical College Hospital (DMCH), Secondary Standard Dosimetry laboratory of Bangladesh Atomic Energy Commission (BAEC), Bangladesh Council Scientific and Industrial Research (BCSIR), where practical classes are taken. Outside the country it collaborates with the Saroj Gupta Cancer Center and the Research Institute (formerly known CCWHRI), Thakurpukur, Kolkata, School of Biomedical Engineering, Jadovpur University, Kolkata, India, North Bengal Oncology Center, Siliguri, India, Mannheim Medical Center, Heidelberg University, Germany. The cooperation agreement includes knowledge transfer by exchange of faculty members, the Teachers Fellowship Program to provide a supportive professional experience for fresh recruits, up gradation of the Department of medical Physics of Gono Bishwabidyalay, joint research for M. Sc and Ph. D students.



Fig. 1: Students working in a Biomedical engineering lab.

Up to 2013, after the establishment of the MPBME department, many students were awarded M. Sc degree and B. Sc. degree in MPBME. At present these graduates are working in the radiotherapy department of the public hospitals; National Institute of Cancer and Research Hospital (NICRH), in the radiotherapy departments of Dhaka Medical College Hospital, Bangabandhu Sheikh Mujib Medical University (BSMMU) and Combined Military Hospital (CMH) and in the radiotherapy departments of different private hospitals; the United Hospital, Square Hospital, Khwaja Yunus Ali Medical College and Hospital, Ahsania Cancer Mission and Hospital or are teaching Medical Physics and Biomedical Engineering in Gono University.

Selected students perform their project work in India and also in different local radiotherapy hospitals. Both bachelor and master students, teachers are attending national and international conferences every year, publishing journals, papers and abstracts. The syllabuses of both courses are based on international standards which have already been

published in the book ‘Medical Physics and Engineering education and training 2011 of IOMP and discussed on many international conferences. The latest books and publications are available in the department; most of the books and equipment are directly sent from Germany. The international conference at Gono University in spring 2011 with participation of more than 250 delegates with 11 countries considered as a further highlight of the efforts to align the quality level to international standards.

## V. CONCLUSION

In summary, the quality of Medical Physics education was improved such that the number of students is continuously increasing. At present the need to provide qualified Medical Physicists in the country can be served only partially by these physicists, however, we are sure that in the near future Gono University will produce a greater number of Medical Physicists and thus contributes for an appointment of them in all government radiotherapy hospitals after creation of medical physicist positions.

The establishment of Medical Physics and Biomedical Engineering Education in Gono Bishwabidyalay (University) is a success story for Bangladesh. We would like to continuously develop strong and advanced Medical Physics and Biomedical Engineering Programs for education and research by incorporating the latest developments of Imaging and Radiotherapy. For the future we would like to establish a further close collaboration with other foreign universities and research institutes. We would be glad to participate in international scientific conferences in order to enhance our potential for a better treatment of the cancer patients in our country.

## REFERENCES

- [1] Hasin Azhari Anupama, Golam Abu Zakaria, G. H. Hartmann(2008) Medical Physics Education in Bangladesh and Cooperation with Germany. WC IFMBE Proceedings 25/XII: 173–176.
- [2] Hasin Azhari Anupama, Zakaria Golam Abu, Asgar M. Ali. (2011) Medical Physics and Engineering Education and Training. IOMP (International Organization of Medical Physics), ICTP, Trieste, Italy.

Contacts of the corresponding author:

Author: Dr Hasin Anupama Axhari  
 Institute: Gono Bishwabidyalay  
 Street: Nolam  
 City: Dhaka  
 Country: Bangladesh  
 Email: ahasinanupama@gmail.com