

## **Presidential Address (2001)**

### **Physics Education in Sri Lanka**

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Physics Education in Sri Lanka is becoming a subject of discussion among the Physics community again due to certain proposed amendments to the selection criteria for university admission to Medical, Dental and Veterinary Faculties. At present the University admission is purely based on the results of the G.C.E. Advanced Level Examination. In the case of Medical, Dental and Veterinary sciences, students are supposed to sit for Physics, Chemistry and Biology papers at the A/L examinations, and for Engineering and Physical Sciences the relevant subjects are Physics, Chemistry, and Combined or Higher Mathematics. However, the Advanced Level Examination is generally considered as a certificate examination defining a certain standard of achievement, and the examination results are used to recruit students to various other institutes such as Technical Colleges, and Teacher Training Colleges, and also to fill up vacancies in the government and private sector organizations. The number admitted to the University courses is insignificant when compared to that who uses this as a qualification to gain admissions to various other institutes.

In the case of Physics annually 40,000 to 45,000 students sit for this examination with 50 to 60 percent of them achieving at least the minimum pass-mark level. As in most other countries, the achievement of students at A/L examination is used in Sri Lanka to admit them for various degree programs in the Universities. The number of places available in universities for disciplines in the sciences is rather limited, and as a result the competition among students to secure a place in the university is becoming extremely high. Of the various disciplines available, the Medical and Engineering streams are found to be the most attractive due to obvious reasons, and the almost entire student population in the science stream is in a rat race to gain entrance to a Medical or Engineering faculty in a state University. For example in each year number of students competing for nearly 900 places available in state medical facilities is around 20,000 to 25,000. Non-availability of other attractive avenues for their higher studies causes severe pressure on students, and as a

result, virtually all the students when they enter A/L science classes in schools have only one dream, that is to enter a Medical or an Engineering Faculty. That is the reason why any revisions made in the admission of students to the Medical Faculties could directly affect the A/L teaching at schools.

Recently, the University Grants Commission (UGC) and the Ministry of Education have decided to make Physics an optional subject for biological science stream. Chemistry and Biology become compulsory for the stream and the students are supposed to select their third subject from a basket of subjects comprising of Physics, Combined Mathematics, Higher Mathematics, Economics, Geography, and Political Science. It is understood that this decision has been made in order to give more flexibility to students in selecting subjects. As three-subject aggregate is the only criterion for selection to medical faculties, under these circumstances, the students will definitely go for easy options to score higher marks by dropping Physics.

Physics is a subject that develops the analytical thinking of students, which is quite necessary for the medical profession. When considered that aspect of Physics, one can argue that there is no harm in putting the two mathematics subjects also in the basket. That is correct, but it is very difficult to understand why the other three subjects namely Economics, Geography, and Political Science are placed in the same basket for students to choose, unless some one wants to convert the medical profession to a economical business.

The importance of learning Physics to understand the nature and the development of technology cannot be over emphasised. There is a very strong belief among world-renowned scientists that this century will belong to Biotechnology, Biophysics and Biochemistry. In fact neighbouring countries like Singapore has now even decided to move away from the much needed semiconductor Industry and invest on fields such as Biotechnology. The advances in these areas will automatically lead to new technology, and we in the developing world as end users of this technology should at least be in a position to understand it if we are to use them properly. Even now the medical instrumentation is a highly advanced subject. In order to use these instruments effectively, efficiently, and with some confidence medical doctors should know their physics thoroughly. Some however, argue that the required Physics can be taught at the medical faculties. This argument itself is an clear evidence to the fact that Physics is needed for medicine, but it is not clear at all why they need the knowledge of Economics, Geography, and Political Science for which

they are prepared to sacrifice two years of learning Physics at the secondary level. At this stage it is appropriate to see what the rest of the world is doing in this regard. The table 1 shows the admission requirements set out by the Medical Faculties of several Universities situated at different parts of the world.

It is clear from the table that Physics is compulsory to gain admission to most of the Universities or when there is a choice it is on par with Biology. In British Universities Physics is taught comprehensively as a separate subject at G.C.E. O/L, and A, B, or C grade in Physics is required to gain entrance to Medical Faculties in the UK. The A/L Physics is made an optional subject for those who wish to admit to medical Faculties in the UK universities due to the above reason. This situation is not applicable to Sri Lanka as Physics is not taught as a separate subject at O/L in Sri Lankan schools. It is also interesting to note that some non-English speaking countries have made a pass in English a requirement for medical entrance.

In addition to the above, there are several other far-reaching consequences of this proposed amendment.

- Being an analytically oriented subject, Physics requires a high intelligent level from students for good performance, and therefore it is unfair if the Physics mark is compared with a similar mark obtained from an easy optional subject.
- Because of the proposed amendments, there can be a gradual deterioration of the standard of Physics in the country. This can happen at least in two ways. (a) Due to the availability of other options the number of students offering Physics as a subject at the secondary level will go down (b) There will be a shortage of science teachers with good Physics knowledge to teach at O-level. This can start a chain reaction ruining the Physics education in the country (At present students having only A/L Physics, Chemistry, and Biology are eligible to become science teachers).
- Students entering the Science Faculties will find it difficult to offer Physics as a subject.
- There may be timetable problems (a) at schools in teaching various optional subjects to science students, (b) at the Examination Department when planning out to hold the G.C.E. A/L examination in a relatively short school vacation period.

The present system may have some shortcomings, but before making any changes to it the policy planners should carefully study the proposed amendments and long-term implication

for them. They must also realise that the field of medicine is a discipline that deals with a small percentage of the A/L student population, and it is not advisable to interfere with the entire education system just for the sake of one discipline.

**Some recommendations:**

Following are some of the solutions one can propose for the present situation.

- (1) Continue with the present system without change
- (2) Introduce the proposed system, but with only Physics, Combined Mathematics, and Higher Mathematics as options (the former Bio-Mathematics subject could also be re-introduced as an option).
- (3) Introduce Physics, Chemistry, and Biology as separate subjects at O-level AND then introduce (2) above.
- (4) Introduce a special Physics syllabus with Biological applications for A/L bio-stream under the present system.

**Table 1:** Entry requirements for medical faculties in various universities.

<u>University / Country</u>	<u>Entry Requirements for Medical Faculties</u>
National University of Singapore / Singapore	<b>Physics</b> , Chemistry, and Biology OR Zoology
Indian Universities: Andhra Pradesh (12 Medical Colleges)	Intermediate Exam with <b>Physics</b> , Chemistry, Biology
Assam (03 Medical Colleges)	HSC with <b>Physics</b> , Biology and English with 50 % marks in the aggregate of Science Subjects
Bihar (09 Medical Colleges)	Higher Secondary with <b>Physics</b> , Chemistry, Biology, and English
Gujarat (06 Medical Colleges)	Higher Secondary with <b>Physics</b> , Chemistry, Biology, and English
Goa (01 Medical College)	Secondary School Certificate with at least 50% marks in <b>Physics</b> , Chemistry Biology, and English
Hariyana (02 Medical Colleges)	Senior Secondary with <b>Physics</b> , Chemistry, Biology and English
Himachal Pradesh (01 Medical College)	Pre-Medical or its Equivalent with <b>Physics</b> , Chemistry, Biology, and English

Jammu & Cashmir (03 Medical Colleges)	Senior Secondary with <b>Physics</b> , Chemistry and Biology. The medium is English.
Karnataka (19 medical Colleges)	PUC in <b>Physics</b> , Chemistry, Biology, and English
Kerala	Pre-Degree of Kerala / Calicut University with <b>Physics</b> , Chemistry, and Biology
International Medical University / Malaysia	<b>Physics</b> , Chemistry, Biology, and Mathematics at SPM/O- Level & 03 of the Science subjects <b>Physics</b> , Chemistry, Biology and Mathematics at STPM/A-Level.
University of Hong Kong / Hong Kong	Grade E or above in either 3 AL subjects or the equivalent of 6 AS subjects in either of the following combinations (I) Chemistry; and remainder from the following: <b>Physics</b> , Biology, Pure Mathematics, Applied Mathematics, and Mathematics Statistics, OR (II) Chemistry; the remainder from (I) <b>Physics</b> , Biology, Pure Mathematics, Applied Mathematics, and Mathematics and Statistics; and (ii) any other subject(s) equivalent to not more than 2 AS subjects. Candidates who do not have AL or AS <b>Physics</b> and/or Biology are required to obtain passes in <b>Physics</b> and Biology/Human Biology in HKCEE.
Chinese University of Hong Kong / Hong Kong	Obtained good grades in <b>Physics</b> , Chemistry, Biology and Mathematics in Hong Kong Certificate of Education Examination, <b>AND</b> Passed 05 subjects including Chinese Language and culture and English. Other Three subjects must include Chemistry at the Advanced Level and other two Science Subjects either at AL or sup. AL
Seoul National University/ S Korea	Students entering the College of Medicine are admitted to the two- year premedical course of the College of Natural Sciences at Seoul Nat. University to offer subjects <b>Physics</b> , Chemistry, Biology, English and Korean. (at least 72 semester hours each)
University of Cambridge / Oxford / London / UK	<b>Part A</b> - GCSE or (GCE O-Level) passes at A, B or C in <b>Physics</b> , Biology, and Mathematics <b>AND</b> <b>Part B</b> - Advanced Level passes in Chemistry, and one of the following: <b>Physics</b> , Biology, Mathematics
McGill University / USA	Medical College Admission Test (MCAT) & One full year (2 semesters) university-level courses, with Laboratory work, in each of: General Biology, <b>Physics</b> ,

	General Chemistry & Organic Chemistry
Ross University / USA	Bachelors Degree OR 90 credits of pre-Medical Studies consisting of Inorganic or General Chemistry (with labs), Organic Chemistry (with labs), General Biology or Zoology (with Labs), <b>Physics (with labs)</b> , College-level Mathematics, and English. & MCAT
University of Wisconsin / USA	Passed <b>8 graded credit hours (Full-year sequence)</b> of Biology, Inorganic Chemistry, Organic Chemistry, <b>Physics</b> , and 6 graded credit hours of English, and completion of a course in Algebra
<b>Universities in Sri Lanka</b>	Chemistry, Biology and <b>any one</b> of the following subjects Physics, Combined Mathematics, Higher Mathematics, <b>Economics, Geography, Political Science</b>