

## A Proposed Analysis of College Physics Programs

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The physics curriculum in our colleges and universities is of vital importance today because of our expanded body of knowledge in the fields of space, nuclear energy, and other scientific phenomena. Since the amount of knowledge is increasing at such an unprecedented rate that one cannot hope to learn everything, it will be necessary for the college and university leaders of today to predetermine a course most suitable to meet the needs of the future.

According to statistics released by the American Institute of Physics 5,321 students were graduated with a Bachelor of Science degree in physics in 1961-1962. These students are thus a quite small minority when one considers the number who are training for other professions. Also, the report further divides them into various fields of work. 53% entered industry, 16% went into education, 19% went into government work, 5½ entered the nonprofessional fields, and the final 7% began miscellaneous other employment.<sup>1</sup>

The above information is valuable in emphasizing the importance of providing an effective college program for the students interested in physics. Although the number in the field is small, the demand is great. In our scientific age, mediocre training is not the answer. When stressing the importance of physics, Gerald Holton said, "Physics will control history."<sup>2</sup> This assertion is quite thought-provoking. His inference is that modern weapons, space advances, and other scientific innovations are the decisive factors influencing world actions.

On the belief that college training should be geared to the needs of the future, thorough in content, and taught by people competently trained, a study should be made of the colleges of today. Their competencies and incompetencies must be ascertained so a more beneficial curriculum can evolve.

Certainly there are many aspects which should be considered when one assesses his college's program. Perhaps answers to the following questions might prove basic. Is the staff large enough to offer a good selection of courses? What is the level of professional training held by the staff? Are the mathematics requirements high enough? Do the requirements for prospective high school physics teachers meet North Central standards? How often do the staff members engage in some form of research? Do students have access to a computer? How valuable is the general physics laboratory program? Can the students complete the laboratory reports in advance of performing the experiments? How many hours of advanced laboratory work does the college offer? What type of honors program is provided? Are all students required to take the same general physics course? How many scholarships does the school provide in the field of physics? Is the staff's working load too great?

Some colleges are working to solve such questions as these. Central State College in Edmond, Oklahoma, has reached a degree of success in developing a good physics program. The following is a list of their requirements which will be listed in order that a critical analysis may be made.

### Requirements:

- Thirty-five hours of physics for a Bachelor of Science in physics.
- Twenty-six hours of physics for a Bachelor of Science in Education with a minor in physics.

### Courses:

General Physics	105	Optics
General Physics	115	Thermodynamics
General Physics	205	Physics Laboratory I and II
General Physics	215	Electronics

Atomic Physics  
Circuit Theory  
Mechanics

Electricity and Magnetism  
Modern Physics I  
Modern Physics II (Nuclear)  
Advanced Laboratory I and II  
Solid State

This is a good course selection. An additional course, quantum mechanics, is being implemented and associated mathematics courses through differential equations and vector analysis are required. Over 90% of physics majors have a second major in mathematics.

There are also several good points which should be noted. For example, a division in their general physics curriculum is offered and also a course in solid state, which is not common among state colleges throughout the southwest. Their advanced laboratory program affords the student an opportunity to do independent research. For example, their research has included work by two students who spent four years constructing a  $\beta$ -ray spectrometer and work by another student who spent two years constructing a helium neon laser.<sup>3</sup> (Central State College, 1965).

Obviously many changes need to be made in the physics curriculum and other related aspects of the field of college physics as a whole. The following changes are suggested:

1. Requirements should be common within each state. This requirement would be beneficial in producing a person with a well-rounded body of knowledge in his field. This is not to imply that the courses should be exact with no variety, but the same objectives and major content should be offered.
2. Visiting instructors or an instructor exchange system should be launched in order to capitalize on the professors skilled in the field. This would enable the colleges to increase the variety of specialization.
3. A 24-hour minimum requirement should be completed before one is allowed to teach high school physics.
4. An honors program could be established in all the colleges to help the students who are capable in the field.
5. A common research center could be established within the state or region. This center would be extremely valuable in pooling resources for common use and research, and might induce more professors to do exploratory work. It has been found that in 60% of the colleges, faculty members publish on the average of fewer than one paper every five years, and that those papers sometimes represent work outside their own department.<sup>4</sup>
6. A scholarship program should be established for the outstanding students who need financial aid.
7. Special consideration should be given to students who have taken advanced courses in high school. Although this is not common, some schools are offering advanced physics courses which could be equated with some sophomore level courses in colleges.
8. The "cook book" type of general physics laboratory that may be in existence should be eliminated since we are attempting to attract more of the better students into the field. A challenging, imaginative laboratory can be conducted—perhaps one in which two students perform the same experiment independently, each acquiring valid data of a different nature from the other. This would give the student an opportunity to perform as scientist rather than as a technician.
9. A cooperative program could be formed which would offer summer employment for physics majors, giving them an opportunity to gain valuable experience in their field.

10. Mathematics requirements should include differential equations, vector analysis, and at least one semester of advanced applied calculus.
11. Quality, not *quantity*, teaching should be attained by keeping the number of contact hours for each professor to fifteen or fewer hours per week. According to the findings of the Committee on Physics Faculties in Colleges, fourteen contact hours per week was the average load carried in the 146 colleges studied.<sup>4</sup>

Naturally, every field needs to remain up-to-date. Physics is not the only field with problems, but physics is a field in which teachers and researchers are desperately needed. It is also a field which frightens many students simply by its name or by their lack of interest in it during their early contact with the courses. As Dodd (1966), professor of physics at Arkansas Polytechnic College said: "Physics is not nearly so romantic as the youngsters who want to learn it. Still, after many years of watching disillusionment drive good but immature young talent into fields where the hard grinding necessities are less obvious if no less real, I have come to feel that however right our conception of the world of the physicist, our psychology of the presentation of it is altogether wrong."<sup>6</sup> His statement should be considered. Perhaps an element of interest and practicality could add to its attraction. At any rate, self-evaluation and regulation is needed.

#### LITERATURE CITED

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