

TEACHING OF GRADUATE COURSES TO UNDERGRADUATE STUDENTS

(CONTINUED AND BROUGHT UP TO DATE)

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In order to prod effort and organize endeavor among undergraduate students of more than average ability, it has been found desirable to encourage those of them who satisfy some special requirements, to enroll in and obtain credit for graduate courses. Undergraduate students who took up the courses were put to a severe test—they had to face the same requirements as graduate students; nevertheless, the results have been gratifying as the following account shows.

Over a period of 13.5 years, beginning in the autumn of 1930, the total number of all the enrolled students has reached 89 among whom there have been 26 graduates joined by 61 undergraduates and 2 regular visitors (faculty members with Ph. D. and M. S. degrees, respectively). On the average, there have been slightly less than 1.5 courses per undergraduate student and a little less than 3 courses per graduate. In other words, many undergraduates have taken more than one course: two or even three. Most of them have obtained grades of *A* or *B*; grade *C* has been less frequent; only in two cases there have been *D*'s. All in all this is considered quite gratifying. Sixty-one undergraduates have earned together 265 credits, i. e., 4.35 per student; considering 3 credits for a standard graduate course this average gives slightly less than 1.5 courses per student as mentioned before. By comparison, 26 graduates have earned 228 credits, i. e., 8.77 per student, which averages a little less than 3 courses per student. Yet the total of credits of the whole undergraduate group is 16 percent more than the aggregate number of credits of all graduate students. Naturally, they have obtained slightly better grades than their undergraduate classmates but the difference is small so that the result is rather a credit to the latter.

The contents of the graduate courses offered by the writer (Dept. of Electrical Engineering) in connection with the above practice relate to engineering, mathematics, and mathematical physics while the students have come and continue coming from Depts. of Electrical Engineering, Mathematics, Physics, Chemistry, and Mechanical Engineering—now primarily, if not exclusively, from the ranks of undergraduates who take those courses as "electives" or substitutes for required ones in order to speed their education and raise its level during the war time.

A *basic lecture* method has been adopted with high-standard treatises being offered to students as reference books and used by them as such, as for instance works by Jeans, Planck, Haas, Berg, Page, Bush, etc. There have been no text books and no recitations, but very frequent discussions in the class. The work has consisted of problems, discussions, and questions of a nature to develop the student's capacity for scientific thinking; for instance—"Prove correctness of" such and such a proposition, while the proof itself is not yet known to the student and is not given in the available books; also—"Derive or find an expression for" such and such a magnitude under the same conditions. Students are required to work out problems of this kind independently, or, if proofs or derivations are complicated, with a minimal amount of help from the instructor.