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Applied Mathematics for agronomical engineers in Spain at UPM

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Mathematics, created or discovered, are a global human conceptual endowment, containing large systems of knowledge, and varied skills to use definite parts of them, in creation or discovery, or for applications, e.g. in Physics, or notably in engineering behaviour. When getting upper intellectual levels in the 19th century, the agronomical science and praxis was noticeably or mainly organised in Spain in agronomical engineering schools and also in institutes, together with technician schools, also with different lower lever centres, and they have evolved with progress and they are much changing at present to a EEES schema (Bolonia process). They work in different lines that need some basis or skills from mathematics. The vocation to start such careers, that have varied curriculums, contains only some mathematics, and the number of credits for mathematics is restrained because time is necessary for other initial sciences such as applied chemistry, biology, ecology and soil sciences, but some basis and skill of maths are needed, also with Physics, at least for electricity, machines, construction, economics at initial ground levels, and also for Statistics that are here considered part of Applied Mathematics. The ways of teaching mathematical basis and skills are especial, and are different from the practical ways needed e. g. for Soil Sciences, and they involve especial efforts from students, and especial controls or exams that guide much learning. The mathematics have a very large accepted content that uses mostly a standard logic, and that is remarkably stable and international, rather similar notation and expressions being used with different main languages. For engineering the logical basis is really often not taught, but the use of it is transferred, especially for calculus that requires both adapted somehow simplified schemas and the learning of a specific skill to use it, and also for linear algebra. The basic forms of differential calculus in several variables are an example, maybe since Leibnitz, of the difficulty of balance rigor and usefulness in limited hours of teaching. In part engineers use of mathematics with manuals and now with computers that use packages, general (MAPLE, MATLAB, may be MATHCAD, et. C.) or specific, such as for Statistics, Topography, Structural design, Hydraulics, specific Machines,. . . , and mostly the details of the algorithms are hidden, but the engineer must have in mind the basic mathematical schemas justifying what he is constructing with these tools, the PC being also used for organisation and drawing. The engineers must adapt to the evolution of these packages and computers that get much changed and improved in five or ten years, quicker than the specific engineering environment, and a clear idea of the much more stable mathematical structures behind gives a solid mental ground for that. An initiation to using computers also with a mathematical structure behind is necessary, to be followed in professional life. A specific actualisation of mathematical knowledge is often necessary for some new applications.