REQUIRED COURSES FOR NUCLEAR GRADUATE PROGRAMS: COULD ONE FIT FOR ALL?

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This article does not seek to propose one ideal curriculum for Nuclear-related graduate programs.
Researches in Nuclear arena may differ as black differs from white. Research itself has complex integrated activities using knowledge without regards for disciplines. Moreover, graduate programs themselves are not like discipline-based instruction.
A unique-single model for graduate programs what fits for everyone probably never will exist, even in the future.
Thus, this paper intends to exclusively increase discussions about this subject.
Background
U.S. President Dwight Eisenhower might be pleased to see how his "Atoms for Peace" and the policies evolving from it, opened an era of extraordinary spread of Nuclear Knowledge to foster peace, health and prosperity.
Both the level of research funding and the number of graduate students involved in Nuclear related (mostly on medical, agricultural and ecological applications) in graduate programs have grown significantly in recent years, specially in developing countries.
Growing needs for professionals in specialized nuclear-based fields have provoking graduate programs into doing shifts on their curricula.
Traditional school structure from the 50's 60's and 70's has been modified. That structure used to be very hermetic once it was designed mainly for physics, chemists and engineers, whose are expected solid foundations of Differential Calculus and Theoretical Physics.
To encourage professionals from different arenas into the Nuclear world, graduate program curricula have been changing, resulting smaller number of required courses, and making disciplines more friendly comprehensible.
Nowadays, it is possible to identify Nuclear/Nuclear related graduate programs having one only compulsory course – workload from 60 to 120 hours to introduce and to form the foundations of Nuclear Sciences for a wide range of professional backgrounds - biologists, physicians, dentists, pharmacists, veterinarians, agronomists, geologists and others. Consequently Nuclear Theory itself, its concepts and ideas have been presented by one induction course covering the general background on introductory level intending to be more friendly comprehensible for heterogeneous student bodies. Additionally, following a current directive emphasized in the last years in many countries, graduate programs generically have limited coursework requirements in order to reduce the time expectation of earning degree. Occasionally deeper courses in Nuclear Theory have not been taught due to their non-compulsory status that has resulting in low demand, not enough to set up classes because the students are only required to course disciplines created to meet their needs. Thus, something has being left out or something has being minimized.
Curriculum
The way of Science and Technology have been made available in graduate programs depends on their structure, sequence and completion, hallmarks of curriculum.
Science is a hands-on activity, by its nature. Curriculum theorists point out that an ideal science education curriculum should contain the following: the development of positive

attitudes towards science, the development of rational thinking processes, the development of scientific processes and the development and the improvement of scientific knowledge.
In practice, curriculum generally contains information such as what should be studied, by whom, at what sequence. In graduate studies, those informations are linked to a specific professional occupation or more often to a specific project.
Usually, course selection is by mutual agreement of the student and his/her advisor and designed to be supportive of student's Ph.D or M.Sc. dissertation research plan. Sometimes, the role of advisor is fulfilled later on, what could let the student alone to take decisions prematurely. Sometimes dissertation's research plan changes, what could turn course very specific subject into a bit useless choice. That is why a formalization of a basic course-requirements can be useful, healthy and perhaps necessary.
Courses
Course to cover Nuclear energy and Nuclear radiation principles - sources, methods of utilization, analyses and projections for present and future uses, generally named *Nuclear Science/Engineering*; to cover general principles of radiation, radioactivity, and protection methodology with emphasis on safe operating, handling, and waste disposal procedures, and regulations and biological interactions, generally named *Radiological Safety*; theoretical and experimental study of the principles of radiation, equipment and reactor measurements, generally named *Nuclear Instrumentation*. That forms a triad (60 hours workload each, at least) what is sure to be a solid foundation for a wide range of professionals, giving them basis to Ph.D. or D.Sc. qualifying examination which covers the essential principles of nuclear engineering. Furthermore, that triad guarantees Nuclear knowledge taught can end up being used in-situ, in daily routine laboratory, officers and wherever the student/researcher works, improving safety philosophy at the organizations.
Conclusions
There is no panacea to help us to elaborate one only meaningful curriculum what fits everyone's need. History tell us the way by scientific knowledge has been made available within societies is continuously changing as much as societies and their needs change day by day.
To harmonize instead to unify, that could the answer for the title's question.
It is possible, even probable that not all Nuclear information and skills could be disseminated through separated-subjects. The triad cited latter works as a "endoskeleton" providing a framework that supports the "body", curriculum and research altogether. The triad should be suitable for application in conjunction with other disciplines and supports the demand for interdisciplinary interaction along and across Nuclear research activities.