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Chapter 1 : Nuclear Engineering Graduate Programs | Mechanical, Aerospace, and Nuclear Engineering

Nuclear engineering encompasses all the engineering disciplines which are applied in the design, licensing, construction, and operation of nuclear reactors, nuclear power plants, nuclear fuel cycle facilities, and finally the decontamination and decommissioning of these facilities at the end of their useful operating life.

Datta and Arvind H. Shah Elastoplasticity Theor y Vlado A. Lubarda Energy Audit of Building Systems: Fundamentals and Applications John S. Life and Design Boris M. Barlam, and Frederic E. Kaw Mechanics of Fatigue Vladimir V. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint. Except as permitted under U. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers. For permission to photocopy or use material electronically from this work, please access www. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged. Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe. ISBN hard back: Nuclear engineering--Handbooks, manuals, etc. Nuclear Power Reactors 1. Historical Development of Nuclear Power Miller, John Luxat, Edward G. Duffey, and Paul J. High-Temperature Gas Cooled Reactors Harvego and Richard R. Nuclear Fuel Cycle 7. Nate Hurt and William J. Lineberry vii viii Contents Fehrenbach and Alistair I. Related Engineering and Analytical Processes Heat Transfer and Thermal Hydraulic Analysis Economics of Nuclear Power Nuclear engineering encompasses all the engineering disciplines which are applied in the design, licensing, construction, and operation of nuclear reactors, nuclear power plants, nuclear fuel cycle facilities, and finally the decontamination and decommissioning of these facilities at the end of their useful operating life. The Handbook examines many of these aspects in its three sections. Overview The nuclear industry in the United States U. Even today, the heritage continues to cast a shadow over the nuclear industry. The goal of the Manhattan Project was the production of very highly enriched uranium and very pure plutonium contaminated with a minimum of other plutonium isotopes. These were the materials used in the production of atomic weapons. Today, excess quantities of these materials are being diluted so that they can be used in nuclear-powered electric generating plants. Many see the commercial nuclear power station as a hazard to human life and the environment. Part of this is related to the atomic-weapon heritage of the nuclear reactor, and part is related to the reactor accidents that occurred at the Three Mile Island nuclear power station near Harrisburg, Pennsylvania, in , and Chernobyl nuclear power station near Kiev in the Ukraine in The accident at Chernobyl involved Unit-4, a reactor that was a light water cooled, graphite moderated reactor built without a containment vessel. The accident produced 56 deaths that have been directly attributed to it, and the potential for increased cancer deaths from those exposed to the radioactive plume that emanated from the reactor site at the time of the accident. Since the accident, the remaining three reactors at the station have been shut down, the last one in This accident resulted in the loss of the reactor but no deaths and only a minor release of radioactive material. The commercial nuclear industry began in the s. This marked the beginning of the nuclear power program in the U. The nuclear reactor in a nuclear power plant is a source of heat used to produce steam that is used to turn the turbine of an electric generator. In that way it is no different from burning coal or natural gas in a boiler. The difference is that the source of energy does not come from burning a fossil fuel, but from splitting an atom. The atom is a much

more concentrated energy source such that a single gram of uranium when split or fissioned will yield 1 megawatt day or 24, kilowatt hours of energy. A gram of coal will yield less than 0. Nuclear power plant construction in the U. The Shippingport power station in Shippingport, Pennsylvania, was the first to begin operation in the U. It was followed by a series of demonstration plants of various designs most with electric generating capacity less then Mw. During the late s, there was a frenzy to build larger nuclear powered generating stations. By the late s, many of these were in operation or under construction and many more had been ordered. When the accident at Three Mile Island occurred, activity in the U. In , there was a revival in interest in nuclear power. This change was related to the economics of building new nuclear power stations relative to large fossil-fueled plants, and concern over the control of emissions from the latter. It is this renewed interest that this handbook attempts to address by looking at not only the nuclear power plants, but also the related aspects of the nuclear fuel cycle, waste disposal, and related engineering technologies. The nuclear industry today is truly international in scope. Major design and manufacturing companies work all over the world. The industry in the U. The companies may have new ownership and new names, but some of the people who began their careers in the s are still hard at work and are involved in training the coming generations of workers. It is important to recognize that when the commercial nuclear industry began, we did not have high-speed digital computers or electronic hand calculators. The engineers worked with vast tables of data and their slide-rules; draftsmen worked at a drawing board with a pencil and ruler. The data were compiled in handbooks and manually researched. The first and last Nuclear Engineering Handbook was published in , and contained that type of information. Today, that information is available on the Internet and in the sophisticated computer programs that are used in the design and engineering process. This Handbook is meant to show what exists today, provide a historical prospective, and point the way forward. Organization The handbook is organized into the following three sections: Today these reactors have faded into history, but some of the concepts are re-emerging in new research and development programs. The final chapter in the section introduces the Generation IV reactor concepts. There is no attempt within this section to discuss research and test reactors, military or navel reactors, or space-based reactors and nuclear power systems. There is also no attempt to describe the electric generating portion of the plant except for the steam conditions passing through the turbines. Twenty percent of the electrical energy generated in the U. These reactor systems are described in Chapters 2 and 3 of this section. The descriptions include the various reactor systems and components and general discussion of how they function. The discussion includes the newer systems that are currently being proposed which have significant safety upgrades. This reactor is unique in that it uses heavy water sometimes called deuterium oxide as its neutron moderator. Because it uses heavy water as a moderator, the reactor can use natural uranium as a fuel; therefore, the front-end of the fuel cycle does not include the uranium enrichment process required for reactors with a light water neutron moderator. Even though the basic designs of this power generating system have been available since the s, the reactor concept never penetrated the commercial market to a great extent. Looking forward, this concept has many potential applications because the high temperatures can lead to increased efficiency in the basic power generating cycles. The second section of the book is devoted to the nuclear fuel cycle and also facilities and processes related to the lifecycle of nuclear systems. The fuel cycle begins with the extraction or mining of uranium ores and follows the material through the various processing steps before it enters the reactor and after it is removed from the reactor core. The material includes nuclear fuel reprocessing, even though it is not currently practised in the U. This is done because it is unique to that reactor concept. The first three chapters, Chapters 7â€”9, of the section discuss the mining, enrichment and fuel fabrication processes. The primary fuel used in reactors is uranium, so there is little mention of thorium as a potential nuclear fuel. The primary enrichment process that was originally used in the U. This was extremely energy intensive and has given way to the use of gas centrifuges. During fuel fabrication the enriched gaseous material is converted back to a solid and inserted into the fuel rods that are used in the reactor. Chapters 10 through 12 in the second section discuss the storage of spent fuel, fuel reprocessing and waste disposal. Spent fuel is currently stored at the reactor sites where it is

stored in spent fuel pools immediately after discharge and can later be moved to dry storage using shielded casks. Fuel reprocessing is currently not done in the U. Waste disposal of low-level nuclear waste and transuranic nuclear waste are being actively pursued in the U. The section also includes a discussion of the proposed Yucca Mountain facility for high-level waste and nuclear fuel. Chapters 13 and 14 describe the transportation of radioactive materials and the processes of decontamination and decommissioning of nuclear facilities. Section III of the handbook addresses some of the important engineering analyses critical to the safe operation of nuclear power reactors and also introduces some of the economic considerations involved in the decisions related to nuclear power.

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Chapter 2 : Undergraduate Programs | Mechanical, Aerospace, and Nuclear Engineering

*Nuclear Engineering Handbook (Mechanical and Aerospace Engineering Series) [Kenneth D. Kok] on calendrierdelascience.com *FREE* shipping on qualifying offers. Nuclear power has, in recent years, undergone a major transformation, resulting in major technical developments and a new generation of nuclear scientists and engineers.*

Additional Academic Options How to Declare ME Before a student can declare Mechanical Engineering as their engineering program of study, the following requirements must be met: Students must have completed at least one full term of courses on the UM Ann Arbor campus 12 credits or more and must not have withdrawn for credit to count. Students on Probation or Enrollment Withheld cannot declare a program. The most recent grade counts in repeated courses. Calculus Math , , , , b. Required engineering courses Engr. If you have met the above requirements, please email a request to declare to the Academic Services Office me-aso umich. We will review your degree audit, confirm your eligibility to declare, invite you to a Declaration Orientation, and complete a long-term degree plan with you. Required CoE Core courses are listed below with the number of credits for each course given in parenthesis: As a general guide, the level CoE Core courses should be completed during or before your freshman year, and the level CoE Core courses should be completed during or before your sophomore year. As part of the above CoE Core requirements, the Accreditation Board for Engineering and Technology ABET requires that all CoE students complete 32 credits of non-engineering coursework in math and science during their undergraduate degree: For students who take all courses at UM, the CoE Core requirements account for the 16 credits of math, and 15 credits of science from the chemistry and physics courses; a total of 31 out of 32 required credits. The remaining 1 credit is satisfied by an additional 3 credit Advanced Math course required for ME students. For students who transfer credit for these courses from another institution and do not receive the full amount of credits from UM, an additional math or science course may be required to reach the 32 total credits. The attached list of ABET Science Courses lists the science courses that have been approved to fulfill the missing math or science credits. See the CoE Bulletin for more detailed information regarding this requirement via the " Transfer credits for Core Math and Science " section. Intellectual Breadth As an engineer, it is important that you learn different modes of thought and areas of human accomplishment to better understand the impact of engineering solutions in a global, economic, environmental, and societal context. To assist students to gain a greater scope of diverse knowledge and to facilitate creativity, the College of Engineering CoE requires that students, who have matriculated into the CoE for the Fall term or later, complete the Intellectual Breadth requirement. Under the Intellectual Breadth requirement, each student must select 16 credits of intellectual breadth courses, subject to these rules: No more than 4 credits of PCDC. The remainder of the 16 credits is drawn from any of the LACs. At least 3 credits of Humanities or LACs must be at the level or higher. This is known as the Upper Division requirement. Please note that PCDCs cannot fulfill this requirement. In total, there are 45 credits of required ME Core courses; and together these subjects represent the fundamental technical competencies every mechanical engineering student must learn. The chart below outlines the courses from each of the core areas: Students must seek pre-approval via a petition to the ME Undergraduate Chair for courses not offered by University departments and experiential courses. Please note that ME is considered an experiential course and thus cannot be used to fulfill the Specialization Elective requirement. To complete an online petition, please use this petition link. Please choose "Exception to Policy" and make a brief and thorough rationale describing your request and why this exception should be made for you. One upper level elective must be a level or higher ME class at least 3 credit hours. This may include level classes off the core TE list, but does not have to. Note that ME or ME can fulfill this requirement. Two core classes totaling at least 6 credit hours must come from the following list:

Chapter 3 : Staff View: Nuclear engineering handbook /

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Chapter 5 : Bachelor's Degree | Mechanical Engineering

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Chapter 6 : Nuclear Engineering Handbook - Google Books

Building upon the success of the first edition, the Nuclear Engineering Handbook, Second Edition, provides a comprehensive, up-to-date overview of nuclear power engineering. Consisting of chapters written by leading experts, this volume spans a wide range of topics in the areas of nuclear power reactor design and operation, nuclear fuel cycles.

Chapter 7 : Nuclear Engineering Handbook - CRC Press Book

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Chapter 8 : Nuclear engineering - Wikipedia

Mechanical Engineering graduates work throughout the field of technology, as mechanical engineering is the most widely applicable field of engineering. Career paths range from small startups to the largest.