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REVIEW

A review of "*Handbook of Environmental Engineering 2nd Edition*"

Spellman, F.R. (2024). *Handbook of Environmental Engineering, 2nd ed.*, CRC Press.

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The "Handbook of Environmental Engineering 2nd Edition," not only covers various types of pollution, such as air, water, and soil, but also their complex interactions with ecosystems. It emphasises applications, integrating real-world case studies to demonstrate effective pollution mitigation strategies. This edition gives particular attention to environmental law, outlining recent legislative developments and their implications for both industry and environmental protection. Additionally, it explores resource sustainability, discussing innovative approaches to renewable energy and waste management. Insights from experienced environmental engineers and scientists enrich the content, blending theoretical knowledge with practical experiences. The book also addresses the use of cutting-edge technology in pollution control, underscoring its role in advancing environmental engineering practices.

The introductory part highlights the essential knowledge required for environmental engineering, covering areas like environmental contaminant treatment, waste management, climate change, and sustainable development. Spellman provides the definition of "environment" in this field and underscores the critical role of environmental engineers in employing technology to address environmental issues, manage natural resources responsibly, and balance technological progress with environmental preservation. The next chapter focuses on units, standards of measurement, and conversions, underscoring their essential role in engineering education and practice. Spellman equates a handbook lacking this information to a book missing a table of contents, highlighting the necessity for these details for accuracy in tasks such as assessing energy consumption and understanding hydraulic fracturing processes.

This book provides accessible mathematical concepts to statistical review from chapters 3 to 5, tailored for those with a keen interest in environmental issues. It breaks down complex mathematics operations and illustrates how they apply to environmental practices, making it ideal for readers without a deep mathematical background. The inclusion of trigonometric functions in environmental contexts helps bridge the gap between theoretical mathematics and practical environmental solutions. By reviewing key statistical concepts, the book lays a foundation for understanding the more advanced aspects of environmental engineering. The author's clear and concise explanations of environmental modelling and algorithms, make the fundamental concepts of environmental engineering more approachable for all readers, regardless of their academic or professional background.

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The author employs a strategy that focuses on daily-related phenomena to define technical terms, grounding their explanations in familiar contexts. This method is the foundation of their approach, making complex topics more approachable and understandable. They maintain a language that is simple and easy to comprehend, consciously avoiding unnecessary jargon or overly complex terminology. This choice of language is instrumental in helping the audience become familiar with the subject matter. Each topic has been meticulously arranged in a manner that ensures coherence within each chapter. In discussions related to topics like air combustion, power generation, and gas physics, the authors thoroughly explore concepts such as material balance, compressibility, gas laws, and flow rates. This thoughtful organisation makes the material not only more engaging but also easier to digest.

The 'Handbook of Environmental Engineering 2nd Edition' distinguishes itself notably from Myer Kurtz's (2018) of the same title through its comprehensive inclusion of a chapter dedicated to green engineering. This unique feature in Spellman's handbook underscores its role as an integral part of sustainable engineering, a topic not extensively explored in Kurtz's edition. Spellman's work characterises sustainable engineering as the development of technologies that align with societal demands while respecting the limitations of natural resources and environmental systems. This book emphasises various green energy sources which also include their environmental impacts, air quality, cultural and ecological considerations, water resources, and operational impacts. This holistic approach offers a nuanced understanding of the complexities of green engineering, contributing to a more robust discourse on environmental sustainability.

In this latest edition, the book also addresses modern trends in environmental engineering, particularly highlighting the effects of climate change on water and wastewater infrastructure. This focus on current issues demonstrates the author's commitment to relevance and practical application in the evolving field. Furthermore, the book delves deeply into the physical, chemical, and biological processes underlying environmental contaminants and their treatment. In addition, the inclusion of the latest environmental regulatory requirements according to United State Environmental Protection Agency, makes the book an indispensable resource for professionals seeking to stay up to date with industry standards and practices.

Chapter 7 provides an in-depth analysis of air pollutants like particulates, nitrogen oxides, carbon monoxide, sulphur dioxide, and Volatile Organic Compounds (VOCs), explaining their complex interactions, such as the formation of ground-level ozone from nitrogen oxides and VOCs. It highlights how factors like emission characteristics, duration, location, and meteorological conditions influence the impact of these pollutants. The chapter also notes that certain emissions may not significantly affect climate change, showcasing a nuanced understanding of air pollutants and their varied effects. This comprehensive approach distinguishes the chapter in its thorough examination of air pollution.

In Chapter 8 focuses on the paradoxical human relationship with water: vital for life yet often neglected and mismanaged, leading to pollution and ecological damage. It explores the impact of human activities on water bodies, emphasising the scarcity and contamination of freshwater resources and the need for effective management. The chapter also discusses the role of surface water in the hydrologic cycle, categorises various pollution types including modern contaminants, and advocates for better stewardship of water resources to ensure the sustainability of the Earth.

In the last chapter on Green Engineering, Spellman addresses the environmental considerations of biomass application. While recognising biomass as a promising energy source, Spellman illustrates its historical significance, tracing its use from the Bronze Age until the mid-nineteenth century when our economy predominantly relied on bioenergy from biomass, rather than hydrocarbons. However, a massive shift was accelerated by technology breakthroughs in which biomass only accounted for around 16% of input in industrial sectors in 1989, reducing from around 35% in 1925. This shows that we have moved away from reducing the use of plant-based materials.

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Different from Jacobson (2023), a Stanford University professor specialising in renewable energy, who simply notes the potential for biomass usage to exacerbate air pollution and create conflicts between land used for energy production and that for food crops or biodiversity conservation, Spellman carefully examines many other factors such air quality, resources, socioeconomics, and environmental justice. He states the importance of differentiating between technical feasibility and economic viability by ensuring proper technology, planning, and operation in biomass application.

This handbook is highly recommended for a diverse audience, including students in environmental education, general readers, and professionals in environmental fields due to its comprehensive coverage of key topics in the field. It provides an in-depth practical perspective on pollution and its impact on the natural environment, blending theoretical knowledge with real-world observations and expert experience. The book thoroughly explores environmental law and resource sustainability, offering vital insights into environmental pollution, including air pollution, solid waste management, and soil contamination. Furthermore, its consideration of environmental issues from socio-economic, cultural, and political viewpoints aids in fostering a holistic understanding among students and practitioners, equipping them with the necessary skills and knowledge to effectively address and mitigate environmental challenges.

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