Sanitation Engineering

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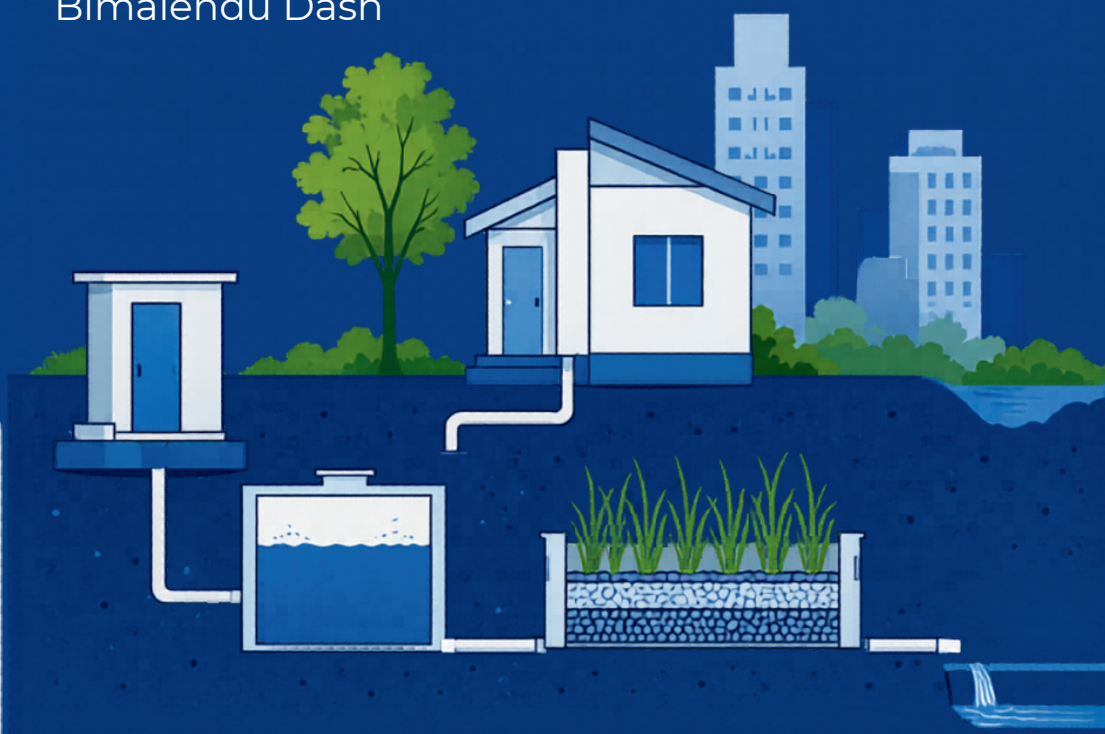

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Next Gen Academic Services Private Limited
1942/2956, Lane R4, Jagamohan Nagar, Khordha, Odisha, 751030, India
e-mail: books@ngenpub.com, Website: https://ngenbook.com/

Published by:

Next Gen Academic Services Private Limited

1942/2956, Lane R4, Jagamohan Nagar, Khordha, Odisha, 751030, India
e-mail: books@ngenpub.com; Website: https://ngenbook.com/

ISBN (eBook): 978-81-686718-9-8
ISBN (Paperback/softback): 978-81-686718-6-7

First Edition: 2026
First Published: 30 May 2026

Composed, Designed & Printed in India

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Dr. Krushna Chandra Sethi is an Assistant Professor in the Department of Civil Engineering at Centurion University of Technology and Management, Odisha, with over eight years of teaching experience. He holds a Ph.D. in Transportation Engineering from Dr. K.N. Modi University, and M.Tech from CSIR-Central Road Research Institute, New Delhi, and a B.Tech from IGIT Sarang, Odisha, along with a Problem-Based Learning certification from Aalborg University, Denmark. His expertise includes flexible pavement design, asphalt mixture evaluation, pavement materials, transportation planning, and Building Information Modelling. He has three patents, over 20 research publications, and has presented at national and international conferences. He also served as Principal Investigator of the TEQIP-III project on innovative pothole repair solutions. His contributions have been recognized through awards such as the Best Paper Presentation Award, CSIR Junior Research Fellowship, Best Performer Faculty Award, and the Eminent Achiever Award from CUTM.

Prof. Singampalli Nohini Sandhya is a distinguished nursing professional with over fifteen years of experience in clinical practice, academic leadership, and research, currently serving as Professor-cum-Principal at School of Nursing, Centurion University of Technology and Management, Paralakhemundi, Odisha. She holds a Ph.D. in Nursing and a Master's degree in Obstetrics and Gynecological Nursing, with expertise in intensive care, obstetric procedures, evidence-based education, mental health, and healthcare reform. She previously served for five years as a Community Health Officer in the government sector, contributing to public health services. A committed educator and researcher, she has published over ten research papers, contributed to books, book chapters, clinical diaries, logbooks, patents, and popular articles, and presented her work at national and international conferences, receiving the Best Paper Presentation Award from IIT Bhubaneswar. Recognized for her mentoring, academic leadership, compassionate approach, and policy engagement, she continues to inspire future healthcare professionals.

Dr. Dattatreya Tripathy is an Assistant Professor in the Department of Civil Engineering at Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra, India. He holds a Ph.D. in Structural Engineering from the Indian Institute of Technology Patna (IITP). His research primarily focuses on structural rehabilitation, masonry strengthening, sustainable construction materials and impact of water quality on it. With 3+ years of teaching and research experience, along with academic leadership roles such as Dean (R&D), he has contributed significantly to engineering education and research. Dr. Tripathy has published 20+ research articles in reputed international journals, conferences, book chapters and technical seminars. His work reflects a strong commitment to sustainable and resilient infrastructure, aligning with modern challenges in sanitation engineering, environmental protection, and resource-efficient construction.

Dr. Bimalendu Dash is a Civil Engineer and PhD holder in Structural Engineering with over nine years of teaching and academic experience. His expertise lies in sustainable construction materials, particularly fibre-reinforced concrete incorporating recycled aggregates. He has taught key civil engineering subjects with a strong focus on conceptual clarity, practical application, and student engagement. Alongside teaching, he has contributed to curriculum development, academic coordination, and quality assurance aligned with modern educational standards. A recipient of the Best Faculty Award, he is committed to bridging the gap between theory and practice. Through his work, he aims to develop accessible and practical learning resources that prepare students to address real-world engineering and sustainability challenges.

Preface

Sanitation engineering stands at the intersection of public health, environmental sustainability, urban development, and human dignity. In an era marked by rapid urbanisation, population growth, climate variability, water scarcity, and increasing environmental concerns, the importance of scientifically planned and efficiently managed sanitation systems has become more critical than ever before. Access to safe sanitation is not merely an engineering challenge; it is a fundamental requirement for healthy living, ecological balance, and sustainable societal progress. The present book, Sanitation Engineering, has been conceived to provide a comprehensive understanding of the principles, practices, technologies, and emerging perspectives of modern sanitation systems.

This book is designed to serve as a valuable academic and professional resource for undergraduate and postgraduate students of civil engineering, environmental engineering, public health engineering, nursing, environmental sciences, and allied disciplines. It will also be useful to researchers, practising engineers, urban planners, healthcare professionals, policymakers, municipal authorities, and development practitioners engaged in sanitation and environmental management.

The authors have made a sincere effort to present the subject in a systematic and multidisciplinary manner by integrating engineering concepts with public health and sustainability perspectives. The book covers fundamental and advanced aspects of sanitation engineering, including water supply and sanitation systems, wastewater collection and treatment, solid waste management, sewerage systems, rural and urban sanitation practices, sanitation-related health issues, environmental protection strategies, and sustainable sanitation technologies. Special attention has been given to contemporary challenges such as climate-resilient sanitation infrastructure, resource recovery, circular economy approaches, decentralised sanitation systems, and sanitation management in developing regions.

One of the major strengths of this book lies in its interdisciplinary approach. Sanitation cannot be addressed solely through technical infrastructure; it requires awareness of human behaviour, healthcare systems, environmental implications, community participation, governance mechanisms, and sustainable policy implementation. Therefore, this book seeks to bridge the gap between engineering applications and public health considerations, offering readers a broader, more practical understanding of sanitation systems and their societal relevance.

The authors acknowledge that sanitation remains one of the most pressing global development concerns despite significant technological advancements. Millions of people worldwide still lack access to safe sanitation facilities, leading to waterborne diseases, environmental pollution, and socio-economic disparities. In countries like India, sanitation has received renewed attention through national missions and sustainable development initiatives aimed at improving hygiene, waste management, and environmental quality. This book aspires to contribute meaningfully to these efforts by strengthening technical knowledge and promoting sustainable sanitation practices among students, professionals, and stakeholders.

The authors express their sincere gratitude to all contributing authors, academicians, researchers, reviewers, and well-wishers whose valuable insights and scholarly contributions have enriched the quality of this book. Their expertise and commitment have played a crucial role in shaping this work into a comprehensive academic resource. The authors are also thankful to their respective institutions for providing continuous encouragement and academic support during the preparation of this book.

We hope this book will not only strengthen conceptual understanding but also inspire innovative thinking, research, and practical solutions in sanitation engineering. It is our earnest belief that the knowledge shared through this volume will contribute toward building healthier communities, cleaner environments, and more sustainable sanitation systems for future generations.

Authors

Contents

Sanitation Engineering

Sanitation Engineering presents a comprehensive overview of the scientific, technical, and practical aspects of sanitation systems essential for protecting public health and environmental quality. The book discusses the planning, design, operation, and maintenance of sanitation infrastructure, including water supply protection, wastewater collection and treatment, sewerage systems, faecal sludge management, solid waste handling, stormwater drainage, and hygiene-related engineering solutions. With emphasis on both conventional and sustainable approaches, the book highlights modern practices such as decentralized wastewater treatment, resource recovery, reuse of treated wastewater, and environmentally responsible waste management. It connects core engineering principles with field-level applications, making the content relevant for academic learning as well as professional practice. The book is designed for undergraduate and postgraduate students of civil engineering, environmental engineering, public health engineering, and related disciplines. It will also serve as a useful reference for teachers, researchers, sanitation planners, municipal engineers, consultants, and professionals involved in urban and rural infrastructure development.

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