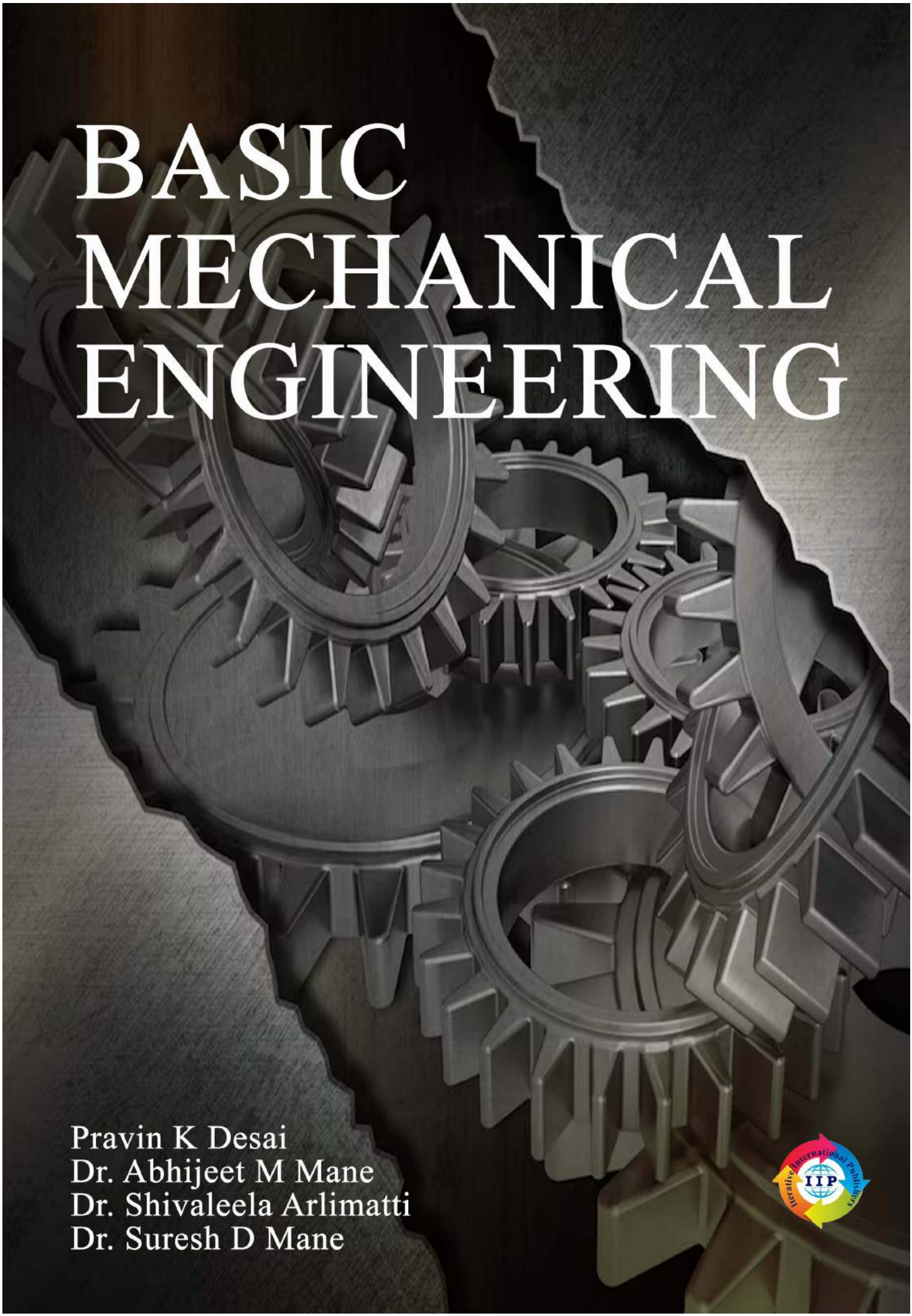
BASIC MECHANICAL ENGINEERING



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Iterative International Publishers
IIP

Basic Mechanical Engineering

First Edition

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Title of the Book: Basic Mechanical Engineering

First Edition - 2023

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E-ISBN: 978-93-5747-281-4

MRP Rs. 250/-

Publisher, Printed at & Distribution by:
Selfypage Developers Pvt Ltd.,
Pushpagiri Complex,
Beside SBI Housing Board,
K.M. Road Chikkamagaluru, Karnataka.
Tel.: +91-8861518868
E-mail:publish@iiponline.org
IMPRINT: I I P Iterative International Publishers

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Preface

Welcome to the magical world of Basic Mechanical Engineering. Mechanical Engineering is instrumental in changing the lives of mankind in all spheres of life. This book is an introduction to the fundamental principles of mechanical engineering. It is intended for first year undergraduate engineering students who are new to the field, as well as for anyone who wants to learn more about how mechanical engineering works.

We have worked in industry and later on have been teaching mechanical engineering for over many years, and we have seen first hand the challenges that students face when they are first learning the material. This book is designed to make the learning process easier and more enjoyable. We have tried to present the material in a clear and concise way, and we have included many examples and exercises to help readers understand the concepts.

This book is divided into six chapters parts:

Chapter I: Fundamentals of Thermodynamics
Chapter II: Introduction to IC Engines, Air Standard Cycles
Chapter III: Introduction to Refrigeration and Air Conditioning
Chapter IV: Energy Sources and Power Plants
Chapter V: Mechanical Power Transmission and Energy Conversion Devises
Chapter VI: Manufacturing Processes

Chapter I covers the basics of thermodynamics viz thermodynamic systems, state, process, cycle, Heat & Work and finally with first and second law of thermodynamics

Chapter II deals with internal combustion engines viz. SI and CI engines, two stroke and four stroke engines, air standard cycles like Carnot cycle, Joule cycle, Otto and Diesel cycles.

Chapter Part III covers refrigeration and air conditioning. including refrigerants, vapour compression cycle, vapour absorption cycle, solar refrigeration, window air conditioners, psychometric properties of air and applications of refrigeration

Chapter IV deals with energy sources and power plants where we discuss renewable and non renewable energy , solar flat plate collector, Solar PV cells, Wind energy , Bio-gas, Bio-diesel, Hydel and steam power plants.

Chapter V deals with types of belts and belt drives, chain drive, types of gears and gear drives, centrifugal pump, reciprocating compressor, Pelton wheel turbine

Chapter VI deals with manufacturing process such as casing, lathe, milling, drilling and finally metal joining processes ie soldering, brazing and welding

We hope that you find this book to be a valuable resource as you learn about basic mechanical engineering. If you have any questions or feedback, please feel free to contact me.

Thank You

We would like to thank all of the people who helped me to write this book. Special thanks to our spouses and, and our children for their support and patience. We would also like to thank our reviewers, who provided valuable feedback on the manuscript.

I hope that you enjoy the book!

Sincerely,

Pravin K Desai
Abhijeet Mane
Shivaleela Arlimatti
Suresh D Mane

Acknowledgement

We would like to thank all of the people who helped us to write this book.
Special thanks to our reviewers, for their valuable feedback on the manuscript. We would also like to thank the publisher for their guidance and support throughout the writing process.

We am also grateful to my colleagues at Dr D Y Patil Pratisthans College of Engineering, Salokhenagar, Kolhapur for their support and encouragement. We would especially like to thank all our mentors, for their guidance.

A special word of appreciation for the esteemed management of Dr D Y Patil Pratisthans College of Engineering, Salokhenagar, Kolhapur for their support and encouragement over the years.

Finally, we would like to thank our family members and friends for their love and support throughout this project. We could not have done it without you.

Thank you to everyone who helped us to make this book a reality.

Sincerely,

Pravin K Desai
Abhijeet M Mane
Shivaleela Arlimatti
Suresh D. Mane

Contents

ABOUT AUTHORS

Pravin Desai is currently serving as the Dean of Admissions at Dr. D. Y. Patil College of Engineering in Salokhenagar, Kolhapur. With a decade of experience in both teaching and administration, he has established himself as a knowledgeable and capable professional in his field. Mr Pravin Desai has made significant contributions to the field of Composite Materials Fan Blade analysis and manufacturing process, having published two patents in this area. Additionally, he has authored two research papers that have been published in reputable international journals.Throughout his career, he has taken on several important roles, such as Dean of Academics, Dean of Admissions, Dean of Student Affairs, and Head of the Department. His dedication and expertise have been recognized, as he was honored with the 'Best Project Guide' award by DIPEX 2017, AICTE ABVP. He has actively participated in seven certified Faculty Development programs and completed certified courses through esteemed institutions like NITTTR, NPTEL, and SWAYAM. His commitment to continuous learning and professional development is evident in his pursuit of these opportunities.

Prof. Dr. Suresh D. Mane has an extensive professional background, having served the South Western Railways for a period of over two decades. However, in 2012, he made the decision to transition from his position as a Gazetted Officer at Diesel Loco Shed, KJM, Bangalore to pursue a career in academia. Since 2015, Dr. Mane has been working as a Principal at AICTE approved technical institutions, , initially at a VTU affiliated Institution and currently at Dr. D. Y. Patil Prathisthan's College of Engineering Salokhe Nagar, Kolhapur, Maharashtra since January 2022. Throughout his career, He has conducted research in various fields, including Biofuels, IC engines, Solar PV, and Accreditation systems. His contributions to these areas have resulted in the publication of numerous articles in 36 esteemed International Journals. He has been invited to deliver talks at AICTE STTPs, ATAL FDPs, and more than 26 institutions across Karnataka, Maharashtra, and Goa. He holds an international Certification in Management and Leadership from the Chartered Management Institute in London, UK. He is a life member of several professional organizations, including ISTE, ISHMT (IIT M), CEGR, SESI, IARP, and Fellow Institution of Engineers. Furthermore, Dr. Mane has demonstrated his expertise in guiding research scholars, having successfully supervised three Ph.D. scholars in 2023 and he has supervised 18 undergraduate projects, with six of them being sponsored by the Karnataka State Council for Science and Technology (KSCST).

Prof. Dr. Abhijeet Mane is an esteemed academician and a leading figure in the field of Mechanical Engineering. Holding a Ph.D. in Mechanical Engineering, he has established himself as an expert in various aspects of the discipline. He has worked in reputed industry at Kolhapur for a year before joining academics at D Y Patil College of Engineering, Kasba Bawda Kolhapur. He served there for over a decade and as a testament to his dedication and contributions to education, he was promoted to serve as the Campus Director of D.Y. Patil knowledge Campus, located in Salokhe Nagar, Kolhapur. Throughout his career, he has demonstrated a passion for education and a commitment to nurturing young minds in the field of engineering. His journey in academia began as an assistant professor, where he engaged students with his knowledge and innovative teaching methods. Over time, he steadily rose through the ranks, displaying leadership qualities and exceptional managerial skills.

Prof. Dr. Shivaleela Arlimatti is accomplished individual in the field of Computer Science and Engineering. She completed her PhD at the University Utara Malaysia, Malaysia, and holds a Master of Technology degree from the University of Mysore, Mysore. Currently, she serves as a Professor and the Head of the Department of Computer Science and Engineering at Dr. D. Y. Patil Prathisthans College of Engineering in Salokhe Nagar, Kolhapur, Maharashtra since Feb 2021. With a remarkable teaching career spanning 17 years, Dr. Arlimatti has made significant contributions to the academic community. Her expertise and dedication are evident in her extensive research work. She has published 17 research papers in both national and international journals and conferences, showcasing her commitment to advancing knowledge in her field. She has contributed to the academic literature through book chapters. Dr. Arlimatti's professional affiliations include being a life member of the Indian Society for Technical Education (ISTE) and the Indian chapter of the Internet Society (ISOC). She is also a member of the Malaysian chapter of ISOC, further highlighting her international connections and collaborations. Through her research, teaching, and active involvement in professional organizations, she continues to make valuable contributions to the field of Computer Science and Engineering, inspiring and guiding future generations of students and researchers.

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E-ISBN: 978-93-5747-281-4

9 789357 472814

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