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BASIC CONCEPTS OF MECHANICAL ENGINEERING

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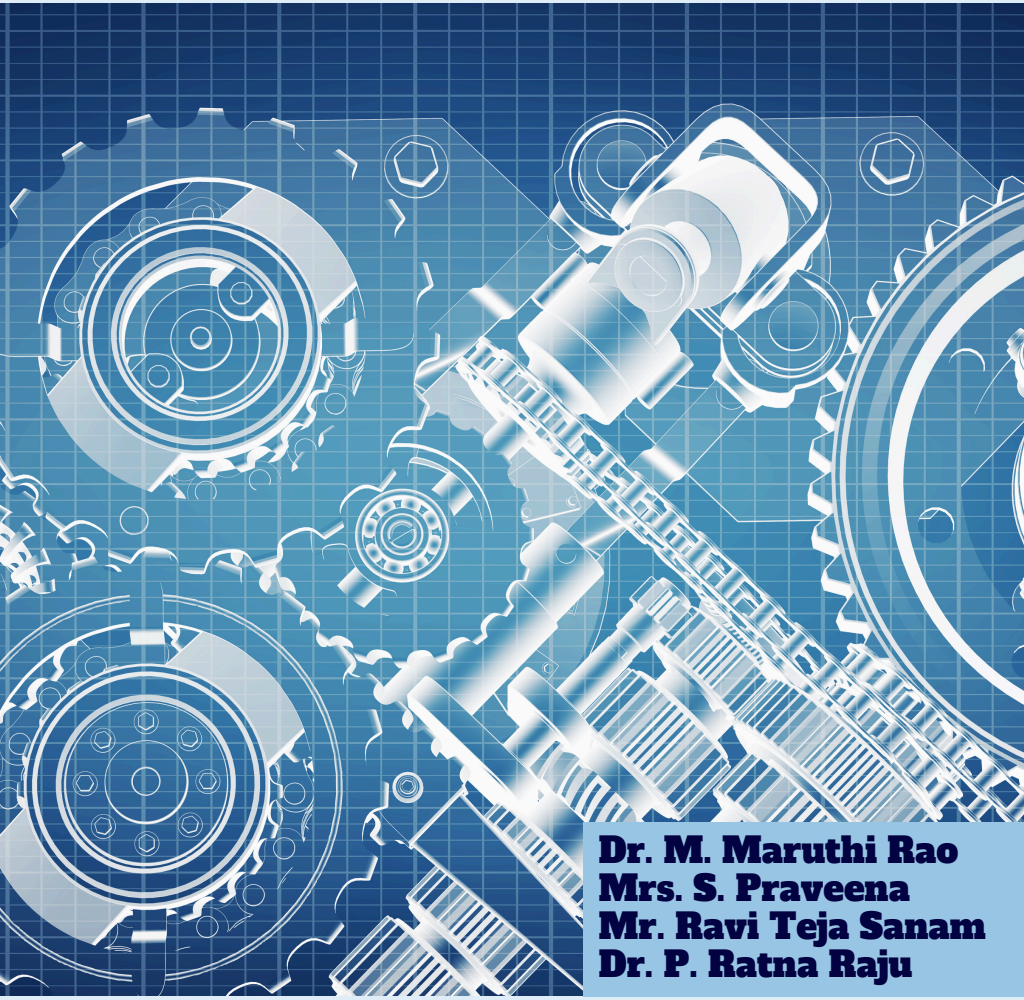

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Mrs. S. Praveena
Mr. Ravi Teja Sanam
Dr. P. Ratna Raju

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Basic Concepts of Mechanical Engineering

Dr. M. Maruthi Rao is an Associate Professor in the Department of Mechanical Engineering at AITS, Tirupati. He holds a B.Tech from Sri Venkateswara University, Tirupati, M.Tech in Heat Power and R&AC from JNTUA, Anantapur, and a Ph.D. from Acharya Nagarjuna University, Guntur. His research focused on the heat transfer characteristics of biological quenching media for Al 2585 alloy. With over 18 years of teaching experience, his areas of interest include heat transfer, renewable energy, thermal engineering, and alternative fuels. He has published extensively in reputed journals.

Smt. S. Praveena is an Assistant Professor in Mechanical Engineering at AITS, Tirupati. She holds a B.Tech and M.Tech (CAD/CAM) from JNTU Anantapur. With over 10 years of teaching experience and prior work as a Design Engineer at AZAD Engineering Pvt. Ltd., her interests include design, manufacturing, materials science, and design software. She has published several research papers in reputed journals.

Mr. Ravi Teja Sanam is an Assistant Professor in the Department of Mechanical Engineering at AITS, Tirupati. He holds a B.Tech from SKIT Engineering College, Sri Kalahasti, and an M.Tech in Thermal Engineering from JNTU Hyderabad. With experience in both academia and industry, his interests include IC engines, thermal engineering, alternative fuels, and practical thermal applications. He has published several papers in reputed journals.

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BASIC CONCEPTS IN MECHANICAL ENGINEERING

(Common to all branches)

(B. Tech I Year I & II Semester as per JNTUA and JNTUK)

Dr. M. MARUTHI RAO
S. PRAVEENA
RAVI TEJA SANAM
Dr. P. RATNA RAJU

PREFACE

Welcome to the world of mechanical engineering! “Basic Concepts in Mechanical Engineering" is your comprehensive guide to the fundamental principles and concepts that form the bedrock of this exciting field. Primarily intended for mechanical engineering students at various levels, it's also a valuable resource for those from other disciplines seeking basic knowledge. We've aimed to make the content accessible to all readers, regardless of their prior experience.

Drawing from our collective experience as educators, researchers, and practitioners, we've strived to present the material clearly and engagingly, emphasizing a deep understanding of core concepts. We encourage active learning through examples, exercises, and thought-provoking questions. Dr. M. Maruthi Rao contributed to Thermal Engineering and Mechanical Power Transmissions. Smt. S. Praveena authored the sections on Engineering Materials and Introduction to Robotics. Sri. Ravi Teja Sanam covered Introduction to Mechanical Engineering, Role of Mechanical Engineering in Various Sectors, Manufacturing Processes, and Power Plants.

We welcome any suggestions, omissions, or error reports for the improvement of this book; they will be acknowledged and incorporated in the next edition.

Dr. M. Maruthi Rao
S. Praveena
Ravi Teja Sanam
Dr. P. Ratna Raju

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The author, **Dr. M. Maruthi Rao**, expresses his sincere gratitude to his children, **Ms. M. Jaya Sri** and **Ms. M. Gnana Sri**, for their kind cooperation and support, which greatly contributed to the successful completion of this book. Their patience, understanding, and encouragement have been a constant source of motivation.

The author, **Mrs. S. Praveena**, gratefully acknowledges **Dr. M. Maruthi Rao** for his expert guidance and unwavering support throughout the development of this book. She extends heartfelt thanks to her parents, **Smt. S. Thulasi Garu** and **Sri S. Venkata Ramana Reddy Garu**, for their steadfast moral support, and to her life partner, **Sri V. Srikanth Reddy**, for his continuous encouragement and belief in her professional journey.

The author, **Mr. Ravi Teja Sanam**, expresses his deep gratitude to his parents, **Smt. S. Prasuna Garu** and **Sri S. Sai Ram Reddy Garu**, for their invaluable blessings and lifelong support. He also offers special thanks to his life partner, **Smt. Sri Durga Sanam**, and their children for their unconditional love, patience, and strength, which were instrumental in the successful completion of this work.

Lastly, the co-authors collectively express their profound appreciation to **Dr. M. Maruthi Rao** for his continued insightful guidance, encouragement, and intellectual mentorship throughout the research and writing process. His contributions have been pivotal in shaping the content and direction of this book.

This book is lovingly dedicated to **our beloved students**, whose curiosity, enthusiasm, and pursuit of knowledge continually inspire us. *With love and gratitude, we acknowledge your role in shaping this journey*.

DR. M. MARUTHI RAO, M.Tech, PhD.

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SRI. RAVI TEJA SANAM, M.Tech.

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FOREWORD

Engineering, often described as the art of turning science into practical solutions, lies at the very heart of human progress. Among its many branches, Mechanical Engineering stands as a beacon of innovation and ingenuity. This field, which blends the principles of physics, mathematics, and material science, has continually pushed the boundaries of what is possible, shaping our world in profound ways.

“Basic Concepts in Mechanical Engineering" is a testament to the enduring importance and fascination of this discipline. In its pages, readers will embark on a journey through the fundamental concepts, theories, and applications that underpin the remarkable field of mechanical engineering.

From the role of mechanical engineers to the technologies in different sectors like energy, manufacturing, automotive, aerospace and marine sectors, “Basic Concepts in Mechanical Engineering" provides a comprehensive foundation for those embarking on their engineering journey. It not only imparts the theoretical knowledge necessary for success but also offers practical insights as real-world engineering applications.

From the invention of the wheel to the development of cutting-edge robotics and aerospace technologies, the impact of mechanical engineering on society has been nothing short of revolutionary. This book encapsulates the essence of that legacy, allowing readers to connect with the spirit of innovation that drives this field forward.

The authors of this book have drawn upon their wealth of experience and expertise to create a work that not only educates but also inspires. Through clear explanations, illustrative examples, and practical applications, they empower readers to explore the endless possibilities that mechanical engineering offers.

May this book be your compass as you navigate the intricate landscapes of manufacturing processes, basics of thermal engineering, power plants, mechanical power transmission, introduction to robotics and may it inspire you to become an architect of a brighter, more innovative future.

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Dr. M. Maruthi Rao received his B.Tech from Sri Venkateswara University, Tirupati, M.Tech in Heat Power and Refrigeration & Air Conditioning (R&AC) from JNTUA, Anantapur, and his Ph.D. from Acharya Nagarjuna University (ANU), Guntur. His doctoral research focused on the heat transfer rate of biological quenching mediums and their chemical characterization, specifically for Al 2585 alloy. With over 18 years of teaching experience, Dr. Rao currently serves as an Associate Professor in the Department of Mechanical Engineering at AITS, Tirupati. He has published numerous research papers in reputed national and international journals. His research interests include heat transfer, renewable energy resources, thermal engineering, and alternative fuels.

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List of topics