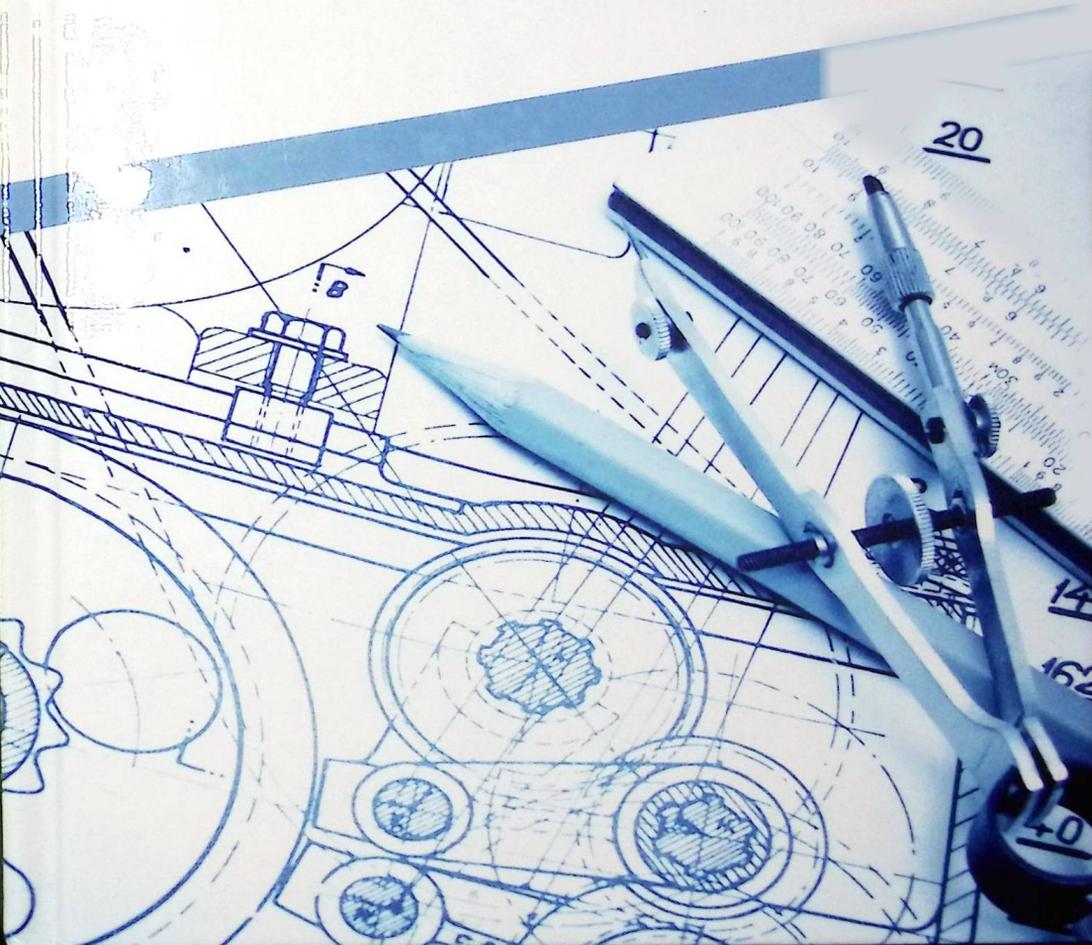


# The Basics of Engineering

Lokesh Pandey



ABOUT THE AUTHOR

# THE BASICS OF ENGINEERING

**Lokesh Pandey**



[www.arclerpress.com](http://www.arclerpress.com)

# TABLE OF CONTENTS

---

<i>List of Figures</i> .....	<i>xi</i>
<i>Glossary</i> .....	<i>xv</i>
<i>List of Abbreviations</i> .....	<i>xix</i>
<i>Preface</i> .....	<i>xxi</i>

<b>Chapter 1</b>	<b>Introduction to Engineering</b> .....	<b>1</b>
	1.1. History of Engineering.....	2
	1.2. Definition of Engineering.....	13
	1.3. Engineering Fields of Specialization.....	14
	1.4. Introduction to the Engineering Profession.....	21
	1.5. Engineering Technology.....	22
	1.6. Introduction to Engineering Design.....	24
	1.7. Engineering Design Process.....	24
	1.8. Conclusion.....	29
	References.....	30
<b>Chapter 2</b>	<b>Engineering As a Profession: An Overview</b> .....	<b>31</b>
	2.1. Introduction.....	32
	2.2. What is Engineering and What Do Engineers Do?.....	32
	2.3. Engineering as a Profession and Common Traits of Good Engineers..	33
	2.4. Common Traits of Good Engineers.....	34
	2.5. What Are Some Areas of Engineering Specialization?.....	36
	2.6. Professional Engineer.....	37
	2.7. Preparing for an Engineering Career.....	47
	2.8. The Engineering Profession and the Engineer of the 21 <sup>st</sup> Century.....	51
	2.9. Societal Issues and Engineering Profession as an Enabling Profession	56
	2.10. Redefining the Ever-Evolving Engineering Profession.....	56

	2.11. The Decreased Durability of the Initial Engineering Education .....	57
	2.12. Determining Whether Engineering is a Profession Here or There.....	58
	2.13. Conclusion .....	61
	References .....	62
<b>Chapter 3</b>	<b>Basics of Mechanical Engineering .....</b>	<b>63</b>
	3.1. Introduction.....	64
	3.2. What is Mechanical Engineering? .....	64
	3.3. Basic Concepts .....	65
	3.4. Computer-Aided Design .....	68
	3.5. CAD Software .....	74
	3.6. 2D Graphics Software.....	74
	3.7. 3D Graphics Software.....	75
	3.8. Graphical Representation of Image Data.....	78
	3.9. Analysis Software.....	79
	3.10. CAD Standards and Translators .....	80
	3.11. Applications of CAD .....	81
	3.12. Product Design for Manufacturing and Assembly.....	88
	3.13. Conclusion .....	92
	References .....	93
<b>Chapter 4</b>	<b>Engineering Communication &amp; Ethics .....</b>	<b>95</b>
	4.1. Introduction.....	96
	4.2. Ethics.....	96
	4.3. Why Study Engineering Ethics?.....	101
	4.4. Engineering Communication.....	102
	4.5. Scope of Engineering Communication and Ethics .....	104
	4.6. Professional Codes of Ethics.....	106
	4.7. The Professional Approach to Engineering Ethics and Codes of Conduct.....	108
	4.8. Ethical Theories.....	110
	4.9. The Importance of Ethical Conduct in Engineering.....	114
	4.10. Parts of Communication System.....	116
	4.11. Types of Signal.....	117

	4.12. Some Moral Issues in Engineering.....	118
	4.13. Conclusion .....	124
	References .....	125
<b>Chapter 5</b>	<b>Engineering Materials and Their Applications .....</b>	<b>127</b>
	5.1. Introduction.....	128
	5.2. Importance of Engineering Materials in Present World .....	130
	5.3. The Evolution of Engineering Materials .....	131
	5.4. Current Trends And Advances in Materials .....	133
	5.5. Classification of Engineering Material .....	136
	5.6. Applications of Engineering Materials .....	143
	5.7. The Future Engineering Materials .....	148
	5.8. Materials and the Environment: Green Design .....	149
	5.9. Introduction to Materials Selection .....	151
	5.10. Conclusion .....	155
	References .....	156
<b>Chapter 6</b>	<b>Mathematics, Probability, and Statistics in Engineering .....</b>	<b>157</b>
	6.1. Introduction.....	158
	6.2. Organization of Text .....	160
	6.3. Probability Tables and Computer Software .....	161
	6.4. Probability and Random Variables .....	161
	6.5. Random Variables and Probability Distributions.....	165
	6.6. Some Important Discrete Distributions.....	167
	6.7. Some Important Continuous Distributions.....	169
	6.8. Observed Data and Graphical Representation .....	173
	6.9. Introduction to Statistics.....	175
	6.10. Descriptive Statistics .....	181
	6.11. Enumerative Versus Analytic Studies .....	182
	6.12. Collecting Data.....	183
	6.13. Conclusion .....	184
	References .....	186
<b>Chapter 7</b>	<b>Applications of Engineering Across Various Fields .....</b>	<b>187</b>
	7.1. Introduction.....	188
	7.2. Types of Engineering .....	188

- Figure 4.5.** Professional codes of ethics
- Figure 4.6.** Ethical risk
- Figure 4.7.** Integrity and honesty play an important role
- Figure 4.8.** Ethics issues in engineering
- Figure 4.9.** Sustainability
- Figure 5.1.** Image showing engineering material
- Figure 5.2.** Non-ferrous metal working waste from Barton upon Humber
- Figure 5.3.** Iron and steel scrap
- Figure 5.4.** Corinthian pottery – ceramics
- Figure 5.5.** Biomaterials made of natural self-assembling proteins
- Figure 5.6.** Materials needs and opportunities
- Figure 6.1.** The ‘mathematics’ gallery of BITM (Inaugurated on 8 May, 2010)
- Figure 6.2.** BITM mathematics gallery
- Figure 6.3.** Illustrates the concept of random variable
- Figure 6.4.** Probability histogram for random variable
- Figure 6.5.** Uniform distribution in probability and possibility
- Figure 6.6.** A normal probability distribution and its equivalent distribution in possibility domain done using probability possibility transformation
- Figure 6.7.** This file shows plotting of twelve different probability distribution functions formed by summing the standard C language library function rand(), for illustrating the Central Limit Theorem
- Figure 6.8.** A plot showing a regular and a cumulative histogram of the same data
- Figure 6.9.** OAIS functional model
- Figure 6.10.** Probability distribution around mean default probability of 10%,  $N=100$ , rho of 0% and 10%. Created using the Gaussian Copula model and 5,000 simulations
- Figure 6.11.** Multivariate gaussian
- Figure 6.12.** Probability distribution functions of log-normal distributions
- Figure 7.1.** Civil engineers doing construction work
- Figure 7.2.** Civil engineering drawing
- Figure 7.3.** Civil drawing and design
- Figure 7.4.** Urban development
- Figure 7.5.** Surveying before construction
- Figure 7.6.** Mechanical lab
- Figure 7.7.** Mechanical engineers at an automotive manufacturing unit
- Figure 7.8.** Mechanical works in construction

**Figure 7.9.** An electrical engineer at work

**Figure 7.10.** Electrical engineering application in robotics

**Figure 7.11.** Tesla electric cars manufacturing unit

**Figure 7.12.** Graphene supercapacitor

**Figure 7.13.** Professionals at work in an IT firm

**Figure 7.14.** Programming and computer science engineering

**Figure 7.15.** Computer science application in health informatics

**Figure 7.16.** Computer science in making geographical information systems