



THEORY



PRACTICE



TECHNIQUES

Theory, Practice and Techniques in **Mechanics**



3G E-LEARNING

TABLE OF CONTENTS

<i>Preface</i>	<i>ix</i>
Chapter 1 Major of Mechanics	1
1.1 Mechanics: An Introduction	1
Perception.....	2
Fundamental Concepts.....	4
The Laws of Mechanics	8
1.2 Sub-disciplines in Mechanics	13
Disciplines.....	13
Classical mechanics.....	15
Theory of Relativity	16
Kinematics	17
Shear force and Bending Moment	18
Summary	24
Knowledge Check.....	25
Review Questions.....	26
References	27
Chapter 2 Theory of Mechanisms	29
2.1 Fundamentals of Mechanisms and its Theory.....	29
Fundamentals.....	30
Motion	31
Mobility	32
Kinematic Pairs.....	33
Number of Degrees of Freedom	41
Planar Mechanisms	42
2.2 Velocity and Acceleration Analysis.....	44
Analysis	44
Driver Link.....	46
RRR Dyad	47
Summary	57
Knowledge Check.....	58
Review Questions.....	59
References	60
Chapter 3 Forces in Structures	61
3.1 The Concept of Force	61
Concept	62
Vector Quantity.....	63

	Mass and Forces	64
	Forces and motion.....	67
3.2	Moments of forces.....	70
	Concept	70
	The Rotational Effects of a Force.....	71
	Elements of a Moment.....	72
	Terms Used To Define Motion	75
	Types of Motion	76
3.3	Newtonian Mechanics	78
	Importance.....	78
	Newton's First Law of Motion.....	80
	Newton's Second law of Motion.....	82
	Force, Mass and Acceleration: Newton's Second Law of Motion	85
	Newton's Third Law of Motion	86
	Summary	90
	Knowledge check	90
	Review Questions.....	91
	Reference	93
Chapter 4	Basic Vibration Theory.....	95
4.1	Concept of Vibration Theory.....	95
	Concept	96
	Translational Motion	96
	Rotational Motion.....	97
4.2	Linear Systems with One Degree of Freedom	98
	Equation of Motion	98
	Free Undamped Vibrations	100
	Free Damped Vibrations	103
	Forced Undamped Vibrations	107
4.3	Machines-Tool Vibrations	116
	Actuator Subsystems	117
	Summary	128
	Knowledge Check.....	128
	Review Questions.....	129
	References	130
Chapter 5	Mechanics of Materials	133
5.1	Stability and Mechanics of Materials.....	133
	Overview	134
	Stress.....	135
	Equilibrium	140
	Shear and Moment.....	142

	Normal Stress in Flexure	143
	Beams with Asymmetrical Sections	146
5.2	Torsion, Deflection and Stiffness.....	152
	Torsion	152
	Deflection and Stiffness.....	156
	Deflection Analysis	159
	Summary	167
	Knowledge Check.....	167
	Review Questions.....	168
	References.....	169
Chapter 6	Overview of Thermodynamics	171
6.1	Basic Concepts of Thermodynamic Systems.....	171
	Concept	172
	Types of Thermodynamic Systems	172
	Properties and State of a Substance	174
	Process and Cycles	175
	Energy.....	176
	The Properties of a Pure Substance.....	180
	Work and Heat.....	188
	Transfer of Heat and Work.....	188
6.2	Concept of Entropy	195
	Concept	195
	Equilibrium	196
	Consequences of Equilibrium	199
	Entropy Measurement	200
	Entropy for Perfect Substances	202
	Second Law Efficiency.....	203
	Summary	208
	Knowledge Check.....	209
	Review Questions.....	210
	References.....	212
Chapter 7	Elements of Quantum Field Theory	217
7.1	Overview of Quantum Field Theory	217
	Overview	218
	Quantization of the Classical Atomic Chain	220
	Phonons.....	222
	Propagating Phonons	227
7.2	Quantum Electrodynamics.....	229
	Concept	229
	Classical Theory of the Electromagnetic Field	230

	Quantum Field Theory of the Electromagnetic Field	232
7.3	Standard Coherent States	235
	Definition	235
	Four Representations of Quantum States	236
	Schrödinger Coherent States	241
	Schrödinger Coherent States in the Two Other Representations	242
	Summary	245
	Knowledge Check	245
	Review Questions	246
	References	248
	INDEX	249