

# MECH 325 Reading Guide #1

## Gears and Power Screws

### 1 Overview

The readings outlined in this guide are intended to prepare a foundation of knowledge and skills that will be used in the MECH 325 classes and tutorials. You will have a short multiple choice Readiness Assurance Process (RAP) Quiz on this material. The quiz will primarily test your ability to recall this material; the emphasis is not to test your ability to apply or use the material (that will come later).

This first reading assignment focuses on gears, gear trains, and power screws. The readings are divided into two categories:

- **Required:** the primary source of material for the Readiness Assurance Process (RAP) Quiz. Each student is expected to complete the required readings.
- *Beneficial: additional analyses, derivations, explanations and examples to provide in-depth understanding of the course material. These readings help develop a more complete understanding of course concepts necessary for the tutorials, exercises, exams, and design projects. It up to you whether or not you do the beneficial readings.*

All readings are drawn from the course text: Budynas, R.G. and Nisbett, J.K., *Shigley's Mechanical Engineering Design*, McGraw-Hill. **11<sup>th</sup> Edition page numbers in bold**, 10<sup>th</sup> Edition in regular, 9<sup>th</sup> Edition in italics.

### 2 Readings

#### 2.1 Gear Basics and Gear Types

**Required:** Sections 13-1 to 13-5 (**pp. 682-89** pp. 666-76, 674-84) and Section 15-1 (**pp. 792-94** pp. 778-80, 786-8).

*Beneficial: Sections 13-6 to 13-7(pp. 689-93 pp. 676-79, 684-87), 13-9 (pp. 695-96, pp. 682-3, 690-1), Section 13-10 (pg. 696-698 only, pp.683-85 only, 691-93 only), and Section 13-11 (pp. 700-01, pp.687-8, 695-6).*

This set of readings introduces the different types of gears and the nomenclature used to describe them.

#### 2.2 Forming Gears

**Required:** Section 13-8 (**pp. 693-695**, pp.679-82, 687-90). These readings introduce the different methods for forming gears – important when selecting gears for particular applications.

#### 2.3 Gear Trains

**Required:** Sections 13-12 and 13-13 (**pp. 701-10**, pp.688-97, 696-705). These readings relate to the speed relationships for combinations of gears.

*Beneficial: Example problems from Section 13-13*

## 2.4 Gear Force Analysis

**Required:** Section 13-14 to 13-17 (**pp. 710-22**, pp. 697-712, 705-20). This set of readings outlines the analysis of transmitted and reaction forces on gears and gear trains. Try to understand how the force vectors change with gear geometry but do not try to memorize the equations.

*Beneficial: Example problems from Sections 13-14 to 13-17*

## 2.5 Gear Stress and Strength Equations

**Required:** Section 14-3 and 14-4 (**pp. 751-57**, pp. 737-43, 745-51). These readings introduce the overall procedure for sizing gears based on stress and strength considerations. Try to get a feel for the general process but do not try to memorize the process details, equations, or tabulated data.

*Beneficial: Sections 14-5 to 14-18. In particular, review Figures 14-17 and 14-18 (Roadmaps for gear strength and wear) to see how the various gear factors are determined. Detailed analysis of gear factors will not be covered. Instead, try to get a general feel as to how these gear factors are determined. A similar roadmap is presented on Figures 15-14 and 15-15 (Sections 15-2 and 15-3) for Bevel Gears.*

## 2.6 Thread Standards

**Required:** Section 8-1 (**pp. 422-426**, pp. 402-406, 410-4). This section introduces the basics of threads (of use for power screws as well as threaded fasteners, to come later in the course).

## 2.7 Power Screws

**Required:** Section 8-2 (**pp. 426-29**, pp. 406-9, 414-7only). This section introduces the power screw mechanism and provides the relationships involving power, torque and force.

*Beneficial: Section 8-2 (**pp. 429-33**, pp. 410-4, 418-22). The remaining pages in section 8-2 provide details on thread strength as well as an example for sizing a power screw.*