MECH 325 Reading Guide #4
Springs and Fasteners

1 Overview

In this module, we will be covering springs and threaded fasteners. We will be referencing Shigley's Chapter 10 ("Mechanical Springs") and Chapter 8 (Threaded Fasteners).

As always, 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 all the required readings for the entire module.
- ***Beneficial:*** *additional analyses, derivations, explanations and examples to provide in-depth understanding of the course material. The beneficial readings will not appear directly on the RAP quiz but will help develop the more complete understanding of course concepts necessary for the tutorials, exercises, exams, and design projects.*

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

2 Readings

2.1 Introduction to Springs

Required: Sections 10-1 to 10-4 (pp. **526-26,** 510-3, *518-21*) give an introduction to helical springs and compression springs.

Beneficial*: Section 10-5 provides information on stability and Section 10-6 addresses spring materials.*

Required: Section 10-7 (pp. **535-40,** 520-4*, 528-30*) covers spring design for static loading. *(Example 10-2 is beneficial, but not required reading.)*

Beneficial*: Section 10-8 (*pp. **542-3,** 526-8**,** *534-6) discusses the critical frequencies in helical springs.*

Required: Section 10-9 (pp. **543-7**, 528-31, *536-7*) covers spring design for fatigue loading. *(Example 10-4 and the extended example of Section 10-10 are beneficial but not required.)*

Required: Section 10-11 (pp. **550-7,** 534-42, *542-5*) introduces extension springs.

Beneficial*: First two pages of Section 10-12 (pp.* **557-9,** 542-3, *550-1) introduce torsion springs.*

2.2 Introduction to Threaded Fasteners

Required: First two pages of Section 8-1 **(**pp. **422-23,** 402-3, *410-3*). This section covers the terminology and standards for screw threads. (The rest of the section was already covered in the power screws module; read it if you feel you would benefit from the review.)

Required: Sections 8-3 and 8-4 (pp. **434-7.** 414-9, *422-7*): these sections introduce various types of threaded fasteners and their uses as well as the important concepts of fastener preload and stiffness.

Beneficial*: Section 8-5* (pp. **437-43**, 419-24, *425-30): this section describes the effect of bolt on the fastened members in terms of the stiffness of those members.*

Required: Section 8-6 (pp. **443-6,** 424-7, *432-5*): this section discusses bolt strength and the associated standards. Take a look over the tables but do not memorize any of the information.

Required: Sections 8-7 to 8-9 (pp. **446-54,** 427-34, *435-42*): these sections combine the concepts above into statistical analysis of tension joints. Section 8-7 discusses the external applied load, 8-8 describes the relationship between bolt torque and preload, and 8-9 considers the entire joint. *(The examples are beneficial but not required reading.)*

Required: Section 8-11 (pp. **456-60,** 436-40, *444-8*): this section covers tension-loaded bolted joints subject to fatigue. (*Example 8-5 is beneficial but not required reading.*)

Required: Section 8-12 (pp. **463-9,** 443-9, *451-7*): this section examines bolted joints loaded in shear. Pay particular attention to the section on eccentric loading (pp. **447-9**, 455-7, *439-41*). (*The examples are beneficial but not required reading.*)

2.3 Additional Information on Bearings (not part of RAP Quiz)

For this section, briefly review the *SKF Bearing and Installation Guide* found on the Canvas website (Papers Related to MECH 325 Folder). This manual has some good practical information related to roller bearings. It will not be tested for the RAP quiz.

Beneficial**: First section highlighting the different bearings types (pp.* **3-7). Illustrations showcase the variety of bearing types. Pay attention to the difference between the Self Aligning Ball Bearings (Fig. 7&8) and the Spherical Roller Bearings which also allow for self-alignment (Fig. 25&26).*

Beneficial**: Section on Shaft and Housing Fits (pp.* **51-7). This section highlights the importance of the interference and clearance fits. The Tables following the discussion are the ones that you would follow when applying tolerances to your drawings.*

Beneficial**: Lubrication Section. This portion discusses several important considerations when it comes to lubrications. The first pages (pp.* **87-8) is a concise introduction. It is suggested you look at the methods of oil lubrication (pp* ***91-2***). *Several of these methods also relate to chain drive lubrication (oil spray, etc.) The final section discusses lubrication using grease (pp.* ***93-5***). *Grease is a common bearing lubricant for slower speed and high load applications.*

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