Assignment/Tutorial 7 March 31, 2017
ME-30602, 2016-17 Spring Semester

1. Problems 13.2, 13.3, 13.6, 13.7, 13.8, 13.10, 13.11, 13.12, 13.14, 13.15
From Chapter 13 of Shigley's Mechanical Engineering Design book. (On Gears – General).

2. Problems 14.1, 14.3, 14.6, 14.10, 14.11, 14.19, 14.20, 14.32, 14.38, 14.39
From Chapter 14 of Shigley's Mechanical Engineering Design book. (Spur and Helical Gear Design).

Note: The problems are picked from 10^{th} edition of the book. In case you have a different edition the problem numbers may change. You should check this.

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Problem: Desired parameters for a spur gear set to be designed are given in the table below.

Pressure Angle, ϕ	20^o
Gear Ratio, m_G	4
Center to center distance, c	200mm
Pinion Material	2.5% Chrome Steel Grade 2 with Hardness HB 250
Gear Material	2.5% Chrome Steel Grade 2 with Hardness HB 200
Quality Number Q_v	10 (precession gearing)
Mounting	Accurate mounting, at the midspan between two bearings, with low bearing clearance, enclosed.
Power source	Light Shock (see fig 14-17, page 766)
Driven Machine	Heavy Shock (see fig 14-17, page 766)
Desired Reliability on life	0.99
Desired Pinion Life, N	10^8 cycles
Power Rating, H	25kW
Pinion Speed, n	2000rpm
Face width, b	50mm
Ratio of rim thickness to tooth depth	1.5

(a) For the above gear set first decide on the number of pinion teeth and module.

(b) Determine the factors of safety against bending (S_F) and pitting failure (S_H) of the pinion tooth and gear tooth (you should determine four such factors).

(c) Compare S_F with $(S_H)^2$ and determine which failure mode is likely to occur and which component (gear or pinion) is likely to fail first.

(d) Calculate the power rating at which the set will fail.

Notes:

1. Assume the strength against pitting resistance S_c=1350 MPa (for both gear and pinion).
2. For surface factor use $K_s = 1$.
3. Obtain the load distribution factor K_H from table given.
4. Obtain elasticity coefficient Z_E from table 14-8.
5. Obtain bending-strength geometry factor Y_J from figure 14-6 and pitting-resistance geometry factor Z_I using Eq. (14-23).