

Design Update 3: Lectures 13-18 – Final Design Only

- Stress concentration & stress intensity factors
- Identification of simple, reversed, fluctuating, or combined loading
- Failure criteria, constant life curves
- Identification of the highest loaded bolts joint with analyses (tension, shear, and failure)

12	Design 3:
1.5	<ul style="list-style-type: none"> - Clear Assembly drawing showing how the mechanism works, meeting requirements
1.5	<ul style="list-style-type: none"> - Clear FBDs showing variables for output torque calcs
1.5	<ul style="list-style-type: none"> - Clear calculation for output torque calc based on design
1.5	<ul style="list-style-type: none"> - Initial value for train value based on design and reasonable assumptions - For gear trains: <ul style="list-style-type: none"> o Breaking up the train value into stages o Check N values for interference o Define final N values and draw out shafts for gearbox o Define types of gears and loads they exert on the shafts, with FBDs
1.5	<ul style="list-style-type: none"> - For Belts <ul style="list-style-type: none"> o Define the diameters, center distance, belt thickness, width, and material using the required torque and defining required initial and maximum tensions.
9	Final Design:
4	<ul style="list-style-type: none"> - Discuss assembly methods for transmission parts and bearings, with relevant fits.
5	<ul style="list-style-type: none"> - Discuss bearing positions and types based on transmission loads for all shafts.

Design Update 3

Total Pts. (out of 50)	Report Component
5	Gantt Chart
5	Bill of Materials (BOM)
4	Stress Concentrations
2	- Stress concentration factor for any transmission shafts or custom parts (machined, laser cut, 3D printed)
2	- Notch sensitivity for any transmission shafts or custom parts (machined, laser cut, 3D printed)
17	Fatigue Failure
2	- Outline minimum and maximum stress at point of highest stress for each transmission shaft
2	- Outline mean and alternating stress at point of highest stress for each transmission shaft
2	- Calculate the life for each transmission shaft, in number of cycles
2	- Calculate the endurance limit with the proper Marin factors for each shaft
2	- Calculate the first yield check for each transmission shaft
2	- Determine the 2 most relevant fatigue failure criteria for your project with rationale
2.5	- Calculate the factor of safety using your 2 chosen criteria for each transmission shaft
2.5	- Calculate the endurance limit with the proper Marin factors
19	Bolt Analyses
2	- Determine the three bolts with the highest load, with required FBDs from assembly. The bolts must be from different joints
2	- Calculate the stiffnesses for each member in the joint for each of the selected bolts
2	- Calculate the stiffness constant and load taken on by each of the selected bolts
2	- Calculate the torque estimate for each bolt selected
2	- Calculate the tensile stress and the factor of safety against static stress for each bolt selected
2	- Calculate the factor of safety against overloading and load separation for each selected bolt
2	- Calculate the minimum and maximum load on the selected bolts
2.5	- Calculate the midrange and alternating stress for the selected bolts
2.5	- Calculate the factor of safety for your selected fatigue criteria with rationale for your choice