

ME 308 Machine Elements II

First Project (Spring Design)

Name/ Surname:

Due Date: / 17:00

- A) Two axle train wagon suspension arrangement is shown in figure A. This system has six nested springs. These nested springs' schematic representation is illustrated in figure B. Weight of wagon is equally distributed to six nested spring system. (See the auxiliary views in Figure C.) Springs are exposed to weight of wagon initially. The load acting in this system may increase due to carrying goods in proportion of load ratio (Given in 3rd page).

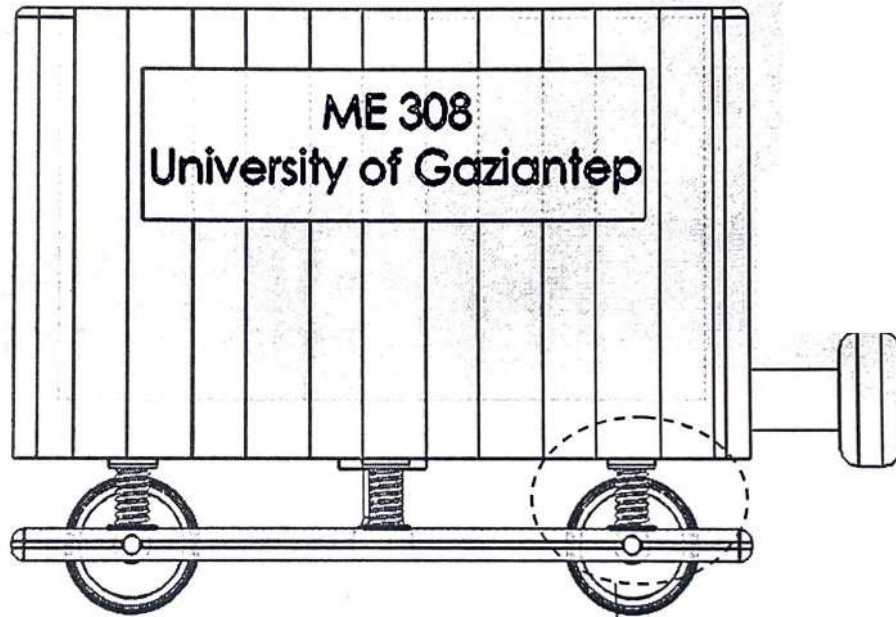


Figure A

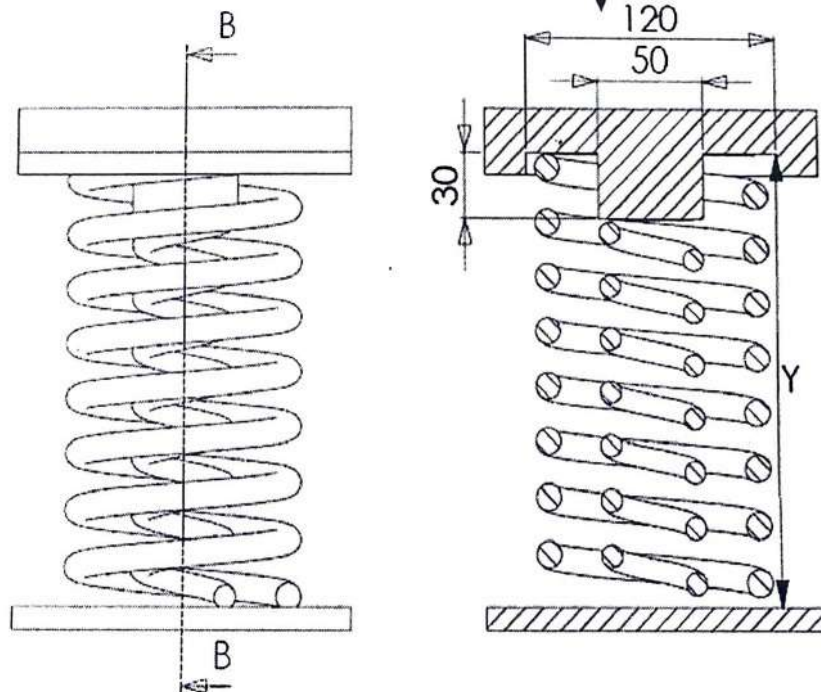


Figure B

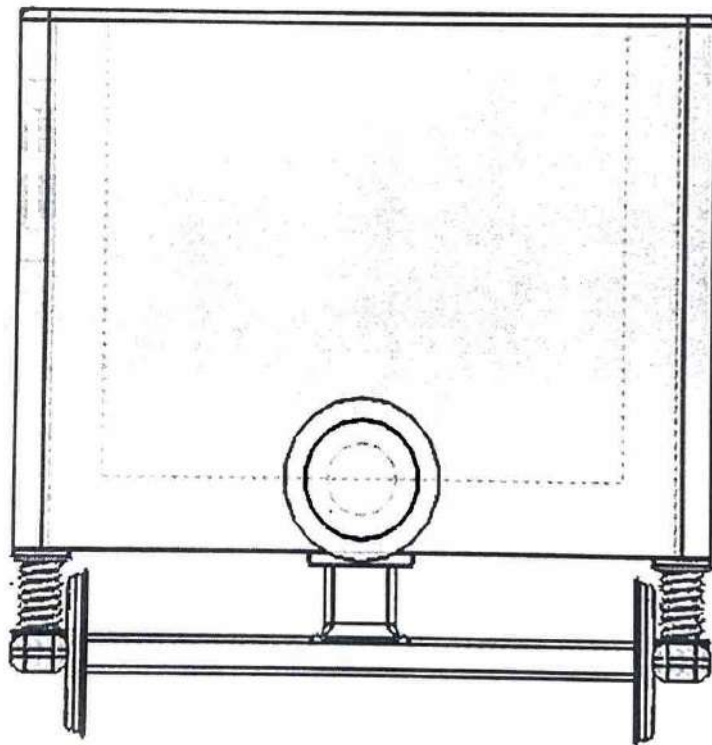
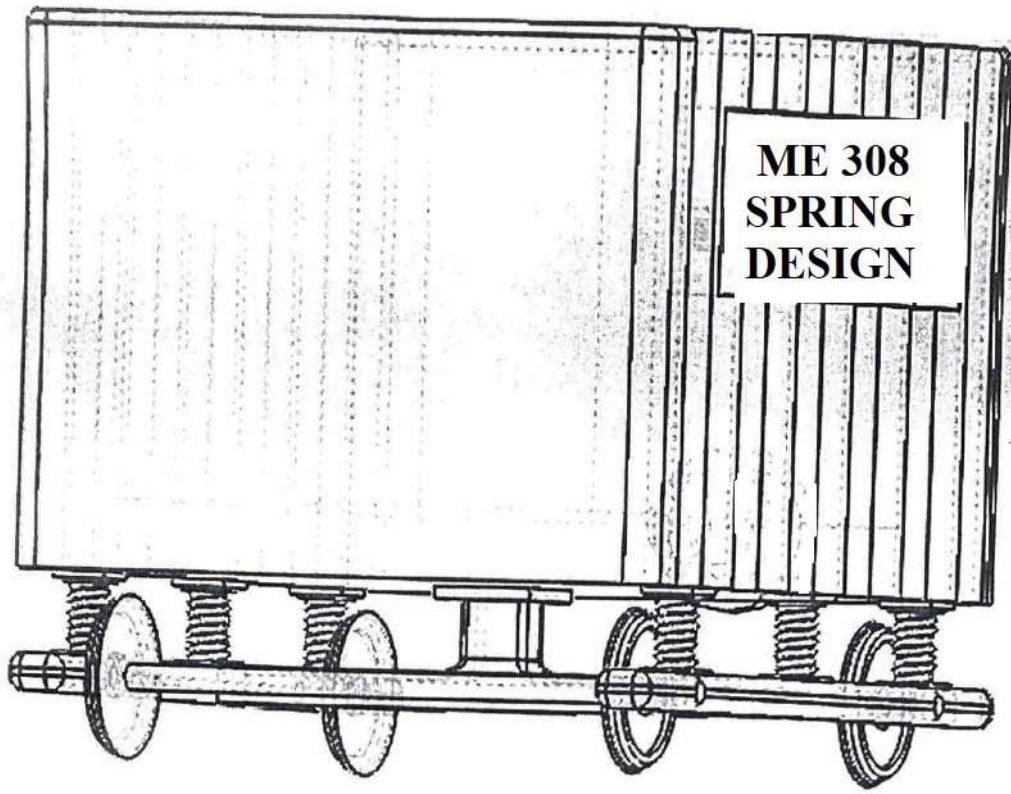


Figure C

The springs	: unpeened	peened	
Wagon weight	: 600 kg	800 kg	1000 kg
Load ratio (F_{max}/F_{min})	: 2	2.5	3.5
Initial compression due to wagon weight	: 10 mm	12 mm	14 mm
Spring rate for outer spring	: 50×10^3 N/m	55×10^3 N/m	60×10^3 N/m
Deflection of the outer spring			
for solid length	: 40 mm	45 mm	50 mm
End conditions	: plain	squared&ground	plain&ground
Spring material	: hard drawn	oil tempered	chrome van.
Frequency of load	: 2 cyc/s	1.5 cyc/s	3 cyc/s
Factor of safety	: 2	2.5	3
Expected life	: 2×10^5	infinite	5×10^5

Design the inner and outer springs (coil diameters, wire diameters, total number of coils and free lengths) for the expected life by satisfying both strength and geometrical requirements. Check the results for all failure types. If surge and/or buckling is a problem, redesign the springs.

Also determine whether permanent set occurs if a load is applied to springs to be solid and the distance between upper and lower supports (Y). You can make necessary and reasonable assumptions.

NOTE: In case you can not reach a feasible design with the information provided, you "have to prove that a feasible design can not be reached". In such cases you have to suggest a logical and acceptable design modification to the application which provides a feasible design. At the end, you have to provide a design solution with all the manufacturing parameters determined.

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