Module 3: Assignment 1

Problem Statement:

You are a design engineer at a renowned automotive company specializing in developing high-performance sports cars. Your team has the task of optimizing various aspects of a new sports car model to ensure superior handling, braking, and overall performance on the track. As part of your responsibilities, you need to calculate and evaluate several key parameters related to steering, suspension, braking, and cooling system design.

Objective:

Consider a high-performance sports car equipped with advanced steering and suspension systems, designed for optimal handling and performance on the racetrack. Using the provided formulas, calculate the following parameters for this sports car:

Tasks to be Performed:

1. Steering ratio:
   Given:
   - Steering wheel angle = 540 degrees (1.5 revolutions)
   - Wheel angle = 45 degrees

2. Steering effort calculation (Total Kingpin Torque Required to steer an axle):
   Given:
   - Weight on the axle (W) = 800 kg
   - Friction coefficient (f) = 0.15
   - Track width (B) = 1.5 m
   - Effective radius (E) = 0.4 m

3. Stiffness of a spring or suspension:
   Given:
   - Force applied (F) = 2000 N
   - Displacement (Δx) = 0.05 m

4. Braking force:
   Given:
   - Friction coefficient (μ) = 0.8
   - Normal force (Fn) = 1500 N

5. Total load acting on chassis:
Given:
- Weight of chassis frame = 1200 kg
- Weight of persons = 400 kg
- Weight of other components = 300 kg

6. Speed ratio:
Given:
- Maximum speed = 300 km/h
- Base speed = 100 km/h

7. Volume of PCM in cell :
Given:
- Density of PCM in cell (ρ) = 1000 kg/m^3
- Density of PCM in cell (ρ) = 1000 kg/m^3
- Power absorbed (P) = 5000 W
- Time of power absorption (t) = 1800 seconds

8. Toe alignment:
Given:
- Front tire distance = 1.2 m
- Rear tire distance = 1.15 m

For each parameter, perform the necessary calculations using the formulas and provide the results.