Module 4: Assignment 1

Problem Statement:

You are a systems engineer working for a leading automotive company specializing in electric vehicles (EVs). Your team is responsible for evaluating and optimizing various aspects of EV performance, including duty cycle analysis, telematics, sensor calibration, and electrical system design. As part of your responsibilities, you need to calculate and analyze several key parameters related to EV operation and performance.

Objective:

Consider a newly developed electric vehicle equipped with advanced telematics, inertial measurement units (IMUs), and electrical systems. Using the provided formulas, calculate the following parameters for this electric vehicle:

Tasks to be Performed:

1. **Duty Cycle:**
   Given:
   - Output voltage (Vout) = 12 V
   - Input voltage (Vin) = 24 V

2. **Total Cost of Ownership:**
   Given:
   - Fixed Vehicle Costs (FVC):
   Lease Payments = Rs. 550 per month
   Insurance = Rs. 120/month
   Licenses = Rs. 29/month
   Permits = Rs. 17.50/month
   Registration = Rs. 19.67/month

   - Variable Vehicle Costs (VVC):
   Fuel = Rs. 0.18 per kWh
   Tolls = Rs. 80 per month
   Maintenance = Rs. 88.78/month

3. **Scale factor of the Inertial Measurement Unit (IMU):**
   Given:
   - Output voltage change of the IMU: From 1.5 volts to 3.0 volts
   - Corresponding acceleration change: From 3 m/s^2 to 6 m/s^2

4. **Electrostatic Charge:**

Given:
- Charge of electron (e) = 1.6 x 10^-19 C
- Number of electrons (n) = 5 x 10^6

Calculate each parameter using the formulas and provide the results.