# SAP Assessed Simulation Exercise

**Answer Sheet**

**Part One**

Q1. Submit plot **vaccs.fig** to LEARN

**[5 Marks]**

Q2. Briefly explain what changes have been made to the model between the linear and nonlinear versions. Why has the acceleration response changed in the way it has?

*[Type your answer here]*

**[5 Marks]**

**Part Two**

Q1. Complete the following table.

|  |  |  |
| --- | --- | --- |
| Eigenvalue  () | Damped Natural frequency (Hz) | Description of mode  (what is the mode commonly known as or what function does it have) |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**[15 marks]**

**Part Three**

Q1. Submit the model **drive4inout.slx** to LEARN.

**[4 Marks]**

Q2. Submit the **gains.fig** to LEARN.

**[5 Marks]**

Q3. Use your **gains.fig** figure to answer the following. The sum of the four inertias initialised by init4.m gives the total (rotational, effective) inertia of the drivetrain Find this value and show how it agrees with your bode plot at very low frequency. *(Hint: The bode plot gives the magnitude of output divided by input at each frequency, at very low frequency this is the steady-state constant that multiplies the input to get the output.*

*[Type your answer here]*

**[3 Marks]**

Q4. Over what frequency range does the transmission oscillate with greater magnitude than the engine?

*[Type your answer here]*

**[2 Marks]**

Q5. What mode does this illustrate?

*[Type your answer here]*

**[2 Marks]**

Q6. What is its resonance frequency?

*[Type your answer here]*

**[2 Marks]**

Q7. This mode is not felt in the vehicle inertia. How can you tell this from the frequency response?

*[Type your answer here]*

**[2 Marks]**

**Part Four**

Show how the system response changes as the initial vehicle speed changes (in *init4*, note how init\_speed is used to determine the velocity tyre effect e.g. tyre damper constant,). Do this by repeatedly changing the *init\_speed* using a ‘for’ loop and running the simulation from within MATLAB using the *sim()* command.

Submit (copy and paste) the code you used (above) below.

*[Type your answer here]*

**[6 Marks]**

Plot the vehicle acceleration against time for the tip-in manoeuvre, for your range of initial speeds. Include all the results on the same axes, so comparisons can easily be made. Label the plot appropriately and include a legend (**>>help legend**). Save your plot as **speedvar.fig** and submit this to LEARN.

**[8 Marks]**

How is initial speed related to the tyre damper constant?

*[Type your answer here]*

**[2 Marks]**

How does the change affect the dynamic response, and why is it affected this way?

*[Type your answer here]*

**[4 Marks]**