**ES3E0/ES4D4 Lab 1 Assistant Answer Sheet**

|  |  |  |  |  |  |  |  |
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| **Open Loop System Tests** | | | | | | | |
| **Load = 50%** | | | | | | | |
|  | **Max Current (A)** | **Min Current (A)** | **Pk - Pk Ripple (A)** | **Average Current (A)** | **Period (s)** | **Frequency (Hz)** | **Screenshot (ref)** |
| **Inductor Current**  **50mv/a** | 179mV | 11mV | 42.40 us |  |  |  |  |
|  | **Max Voltage (V)** | **Min Voltage (V)** | **Pk - Pk Ripple (V)** | **Period (s)** | **Frequency (Hz)** | **Screenshot (ref)** |  |
| **Output Voltage** | 254.0mV | -274.0mV | 42.40 us |  |  |  |  |
|  | **Duty Ratio** | **Frequency (Hz)** | **VGS Voltage (V)** | **VDS Voltage (V)** | **Screenshot (ref)** |  |  |
| **Switching Signals** |  |  | 22 |  |  |  |  |
|  | **Input Current (A)** | **Output Current (A)** | **Input Voltage (V)** | **Output Voltage (V)** | **Input Power (W)** | **Output Power (W)** | **Efficiency** |
| **Efficiency** | 1.91A | 1.02A | 30 | 48 |  |  |  |
| **Transient Behaviour (Load = 25%)** | | | | | | |  |
|  | **Initial Voltage (V)** | **Final Voltage (V)** | **Start Time (s)** | **End Time (s)** | **Rise Time (s)** | **Screenshot (ref)** |  |
| **Transient** | 30.0 | 41.8 | -3.66 ms | 15.24 ms | 18.9 ms |  |  |
| **Transient Behaviour (Load = 50%)** | | | | | | |  |
|  | **Initial Voltage (V)** | **Final Voltage (V)** | **Start Time (s)** | **End Time (s)** | **Rise Time (s)** | **Screenshot (ref)** |  |
| **Transient** | 30 | 37.6 | -3.06 | 1.34 | 4.4 |  |  |
|  |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Tests with Proportional Control** | | | | | | | |
| **Step Input Test (Load = 25%)** | | | | | | | |
|  | **Initial Voltage (V)** | **Final Voltage (V)** | **Start Time (s)** | **End Time (s)** | **Rise Time (s)** | **Screenshot (ref)** |  |
| **Transient** | 28.6 | 34.8 | -2.06ms | 440.0us | 2.5ms |  |  |
|  | **Screenshot (ref)** |  |  |  |  |  |  |
| **P Controller** |  |  |  |  |  |  |  |
|  | **Max Voltage (V)** | **Min Voltage (V)** | **Pk - Pk Ripple (V)** | **Period (s)** | **Frequency (Hz)** | **Screenshot (ref)** |  |
| **Output Voltage** | 180m | -48m | 42.4us |  |  | 5 |  |
|  | **Screenshot (ref)** |  |  |  |  |  |  |
| **Duty Ratio** |  |  |  |  |  |  |  |
|  | **Input Current (A)** | **Output Current (A)** | **Input Voltage (V)** | **Output Voltage (V)** | **Input Power (W)** | **Output Power (W)** | **Efficiency** |
| **Efficiency** | 0.564 | 0.384 | 30 | 35 |  |  |  |
|  |  |  |  |  |  |  |  |
| **Output Voltage Change (Load = 50%)** | | | | | | | |
|  | **Initial Voltage (V)** | **Final Voltage (V)** | **Start Time (s)** | **End Time (s)** | **Rise Time (s)** | **Screenshot (ref)** |  |
| **Transient** | 33.8 | 40 | -5.4ms | 4.6ms | 10ms | 6/7 |  |
|  | **Screenshot (ref)** |  |  |  |  |  |  |
| **P Controller** | 8 |  |  |  |  |  |  |
|  | **Max Voltage (V)** | **Min Voltage (V)** | **Pk - Pk Ripple (V)** | **Period (s)** | **Frequency (Hz)** | **Screenshot (ref)** |  |
| **Output Voltage** | 218mv | -194mv | 43us |  |  | 9/10 |  |
|  | **Screenshot (ref)** |  |  |  |  |  |  |
| **Duty Ratio** | 11/12 |  |  |  |  |  |  |
|  | **Input Current (A)** | **Output Current (A)** | **Input Voltage (V)** | **Output Voltage (V)** | **Input Power (W)** | **Output Power (W)** | **Efficiency** |
| **Efficiency** | 1.344 | 0.857 | 30 | 40.2 |  |  |  |
| **Tests with Proportional Integral Control** | | | | | | | |
| **Step Input Test (Load = 50%)** | | | | | | | |
|  | **Initial Voltage (V)** | **Final Voltage (V)** | **Start Time (s)** | **End Time (s)** | **Rise Time (s)** | **Screenshot (ref)** |  |
| **Transient** | 28.8 | 34.8 | -51.4ms | 55.4ms | 106.8ms | 13 |  |
|  | **Screenshot (ref)** |  |  |  |  |  |  |
| **P Controller** | 14 |  |  |  |  |  |  |
|  | **Max Voltage (V)** | **Min Voltage (V)** | **Pk - Pk Ripple (V)** | **Period (s)** | **Frequency (Hz)** | **Screenshot (ref)** |  |
| **Output Voltage** | 710mv | 380mv |  | 42.4 |  |  |  |
|  | **Screenshot (ref)** |  |  |  |  |  |  |
| **Duty Ratio** | 16/17 |  |  |  |  |  |  |
|  | **Input Current (A)** | **Output Current (A)** | **Input Voltage (V)** | **Output Voltage (V)** | **Input Power (W)** | **Output Power (W)** | **Efficiency** |
| **Efficiency** | 1.045 | 0.755 | 30 | 35.41 |  |  |  |
| **Step Input Test with Load Change (Load = 75%)** | | | | | | | |
|  | **Initial Voltage (V)** | **Final Voltage (V)** | **Start Time (s)** | **End Time (s)** | **Rise Time (s)** | **Screenshot (ref)** |  |
| **Transient** | 28.4 | 36 | -266ms | -80ms | 186ms | 20 |  |
|  | **Screenshot (ref)** |  |  |  |  |  |  |
| **P Controller** | 21 |  |  |  |  |  |  |
|  | **Max Voltage (V)** | **Min Voltage (V)** | **Pk - Pk Ripple (V)** | **Period (s)** | **Frequency (Hz)** | **Screenshot (ref)** |  |
| **Output Voltage** | 770mv | 440mv |  | 41.6us |  | 23 |  |
|  | **Screenshot (ref)** |  |  |  |  |  |  |
| **Duty Ratio** | 25/26 |  |  |  |  |  |  |
|  | **Input Current (A)** | **Output Current (A)** | **Input Voltage (V)** | **Output Voltage (V)** | **Input Power (W)** | **Output Power (W)** | **Efficiency** |
| **Efficiency** | 1.509 | 1.119 | 30 | 35.41 |  |  |  |
|  |  |  |  |  |  |  |  |