Roll No.: [22b3936] Marks: 5.0

Question 1.

Motor and load torques are denoted by the following expressions: T (Nmt.) = 10 and T_L (Nmt.) = 0.1ω (ω is expressed in rad/sec). Calculate the time taken for the speed to change from 0 to equilibrium speed. J = 0.1 $\mathrm{kg-mt^2}$.

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CHAT

Roll No.: [22b3936] Marks: 5.0

Question 2.

A train is having 8 coaches and is driven by a locomotive. The locomotive has 20 wheels out of which 10 are driving wheels. Each coach also has 20 wheels. What will be the percentage increment in the maximum tractive effort that the train can develop if it is configured as having 3 motorized coaches, 5 trailer coaches and no locomotive? Each motorized coach has 20 wheels out of which 12 are driving wheels. Assume that the weight of locomotive, a trailer coach and a motorized coach are equal while carrying passengers.

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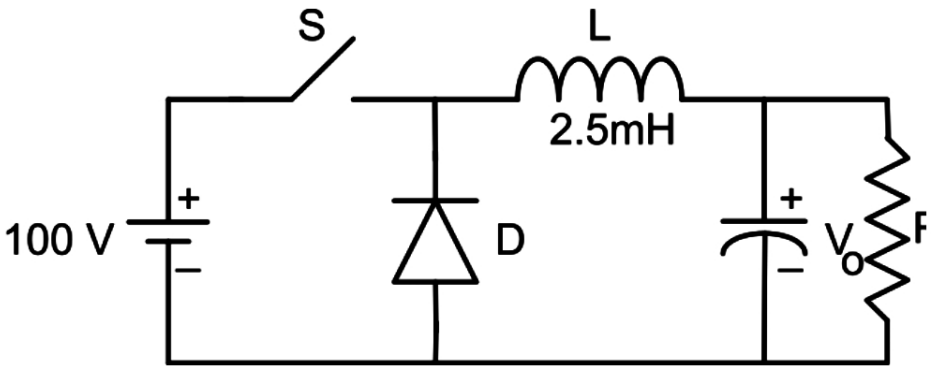
Roll No.: [22b3936] Marks: 5.0

Question 3.

For the buck regulator shown in the figure, the switch, S is operated with a duty cycle of 0.5 at a switching frequency of 5 kHz. The inductor, L is having a value of 2.5 mH. Input voltage to the regulator is maintained at 100 V. The value of the load resistance R_L connected to the output of the regulator is 400 Ω. Find the magnitude of the output voltage, V_0. Assume that the output voltage of the regulator is ripple free.



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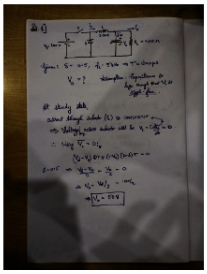
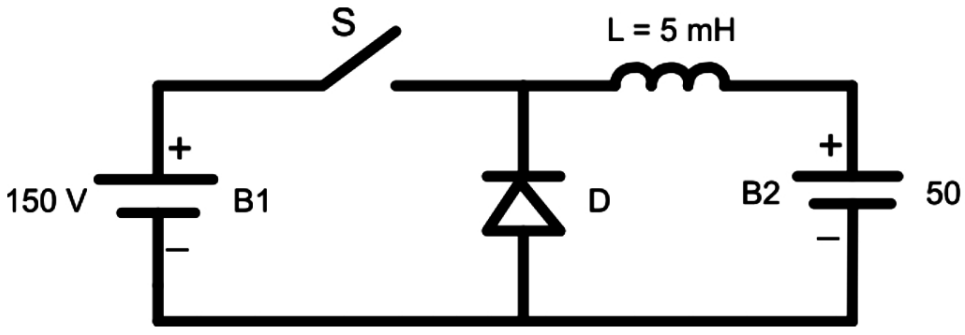


CHAT

Roll No.: [22b3936] Marks: 10.0

Question 4.

A dc to dc converter shown in the figure is charging a battery bank, B2 whose voltage can be considered constant, and is equal to 50 V. B1 is another battery bank whose voltage is constant, and is equal to 150 V. The value of the inductor, L is 5 mH, and the switch, S is operated with a switching frequency of 5 kHz with a duty cycle of 0.4. Once the circuit has attained steady state, 1) determine the power (in watts) that is being transferred from B1 to B2. The duty cycle is gradually being increased from 0.4 to enhance the magnitude of power being transferred. Once the duty cycle crosses the limiting value, ∂_l, the circuit becomes uncontrollable (the current flowing through L keeps on increasing from cycle to cycle). 2) Find the value of ∂_l.



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