Assignment 3 (EE 238)

1. A flyback converter in the figure 1 has the following circuit parameters:
   V_s=24 V
   N_1/N_2=3
   L_m = 500 µH
   R = 5 Ω
   C = 200 µF
   f = 40 kHz
   V_0 = 5 V
   Determine (a) the required duty ratio; (b) the average, maximum and minimum values for the current in L_m; and (c) the output voltage ripple. Assume that all components are ideal. **(Ans: (a)0.385 (b)540 mA; 770 mA;**

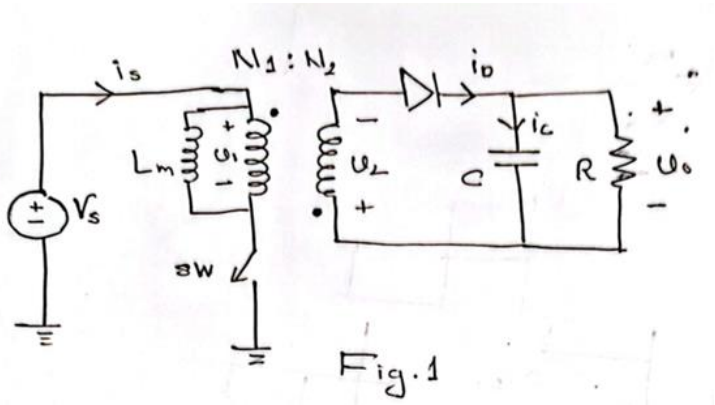
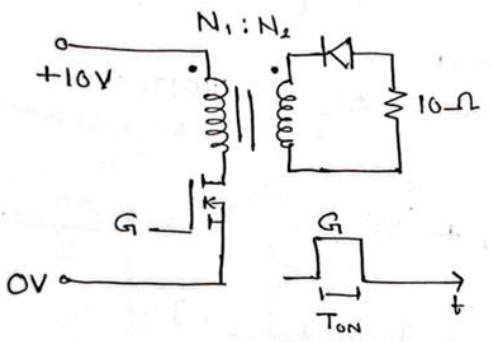


Fig. 1

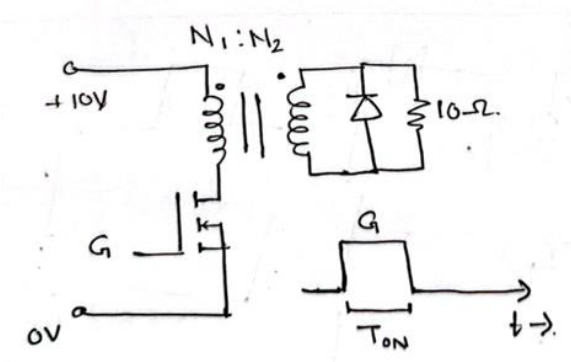
   310 mA (c) 0.96%)

2. A single gate pulse G with duration T_{ON}=100 µs is applied to the switch in the below circuit. The transformer windings have no current in them before the pulse is applied. The turns N_1=N_2. The self-inductance of the primary winding is L_1= 1 mH. Neglect leakage inductances and device

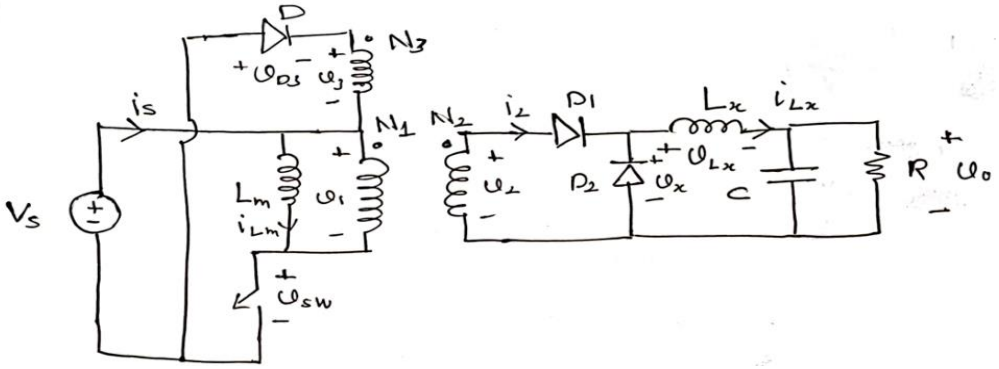


power losses. What is the total energy dissipated in the 10 Ω resistor (in mJ) as t→∞. **(Ans: 0.5 mJ)**

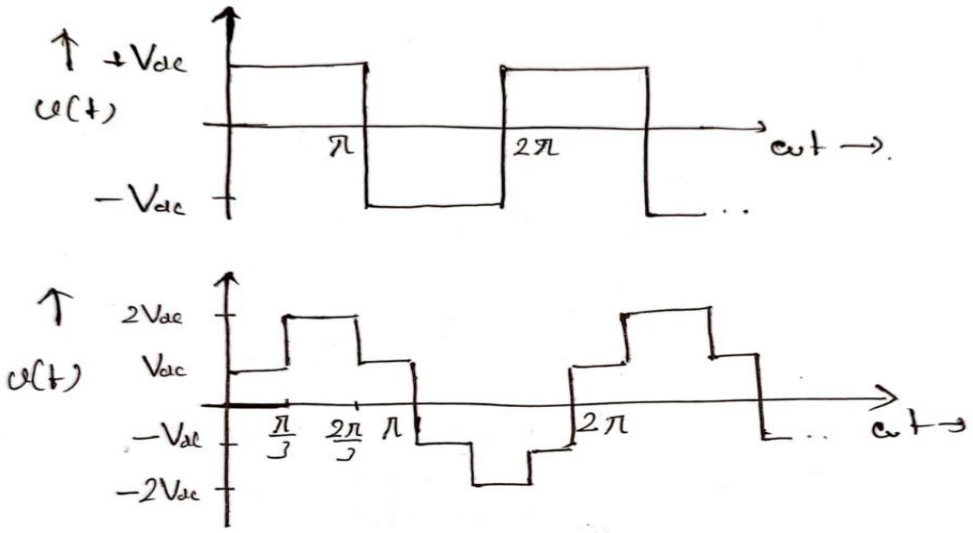
3. A single gate pulse G with duration T_{ON}=100 μs is applied to the switch in the below circuit. The transformer windings have no current in them before the pulse is applied. The turns N_1=N_2. The self-inductance of the primary winding is L_1= 1 mH. Neglect leakage inductances and device power losses. What is the total energy dissipated in the 10 Ω resistor (in mJ) as t→∞. **(Ans: 1 mJ)**



4. The forward conductor has the following parameters.
   V_s= 48 V
   R=10 Ω
   L_x=0.4 mH, L_m= 5 mH
   C = 100 μF
   f = 40 kHz
   N_1/N_2=1.5, N_1/N_3=1
   D=0.4
   (a) Determine the output voltage, the maximum and minimum currents in L_x (b) Determine the peak current in the transformer primary winding. Verify that the magnetizing current is reset to zero during each switching period. Assume all components are ideal. **(Ans: (a) 12.8 V; 1.56 A; 1.01 A (b) 1.15 A)**



5. The following are the voltage waveforms of a square wave and a stepped wave respectively.



(a) Find the fourier series of both the waveforms. (b) Find the THD in both the cases. (c) Comment on the harmonics present in both the waveforms**. (THD in square: 48.43%; THD in stepped: 31.08 %)**