Mid Semester Exam

Subject: EE-307 Power Electronics

Duration: 2 Hours

Note: (Most unlikely but) In case, data is not sufficient to solve any of the above problems, assume necessary parameters and mention assumptions in your answer script clearly.

Q.1: In case of buck converter, if the inductor value is infinity, then determine the capacitor requirement and what will be the value of output voltage ripple---------- 1 Mark

Q-2: In a buck converter, the source voltage is 10V and source resistance is equal to Rs=0.5ohm, Inductor resistance is RL=1ohm and load resistance is R=2ohm. The buck converter is operated with a duty ratio of 50%. Then determine the output average voltage. 3 Marks

Q-3 In a buck converter, the on state voltage drop across the switch is 0.8V and voltage drop across the diode is 0.7V. Buck converter operated with a duty of 50% with source voltage as 10V. Determine the efficiency of buck converter (In percentage). 3 Marks

Q-4 The converter shown in Fig.1 has parameters I_{in} = 12 amp, D = 0.8, R = 100 Ω, L = 20 mH, C1 = 470 µF, C2=infinite µF and a switching frequency of 100 kHz. Determine the output voltage if the current source is ideal?

2 Marks

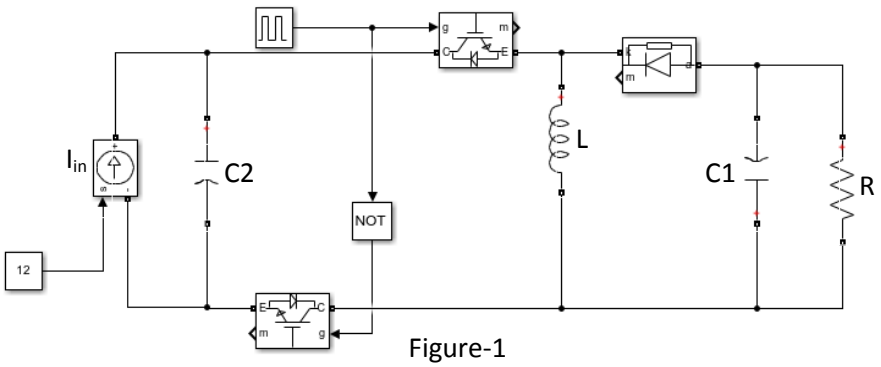


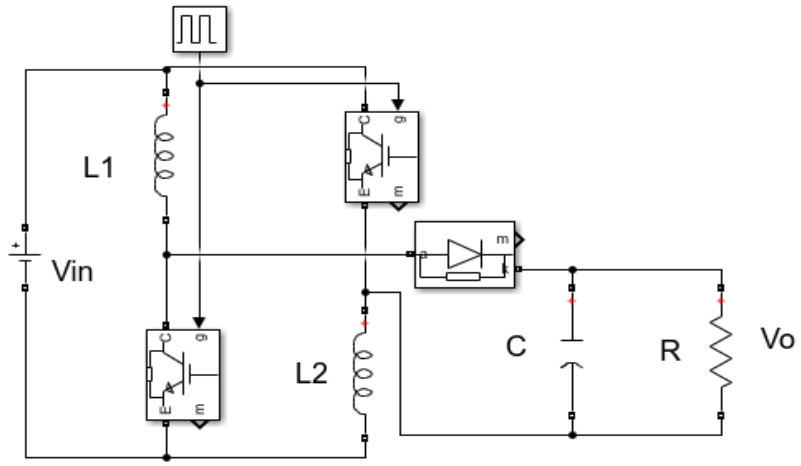
Figure-1

Q-5 The 24V Dc motor is supplied by the 12V battery by boosting the input voltage using suitable converter. The operated Switching frequency of 20 kHz and capacitance at load is 470micro farad.

(a) Calculate L min that will keep the converter in a continuous conduction mode, if Po>=5w. The switch is practical and having on state resistance of 0.001Ω. if switch is suddenly short circuited what would be the load voltage?

(b) if the diode of boost converter is short circuited and the diode is ideal. What would be the average output voltage? 4 Marks

Q-6 Referring to below Figure of Boost Converter where both IGBT switches triggered with same gating pulses and both inductor have same inductance. Determine the input voltage to output voltage ratio in terms of Duty ratio (D)? 3 Marks



Q-7 In a buck-boost converter, L=50µH operating in DC steady state under the following conditions: input voltage is 12 V, duty ratio is 0.6, the output power is 36W and the switching frequency is 200kHz. assume all are ideal components. For this converter

(a) Calculate and draw the waveforms for (I) voltage across the diode, inductor, (II) current through inductor, diode and the capacitor (3 Marks).

(b) Draw the inductor voltage and current waveforms if output power is changes to 18 W; remaining parameters are unchanged. Derive the verdict by comparing inductor current and voltage waveform with results obtain in part 6(a). (3 Marks)

(c) In this converter now assume output load is changing. Calculate the critical value of the output load power below which the converter will enter into the discontinuous conduction mode of operation. (2 Marks)

(d) Calculate the critical value of the inductance 'L' below which this converter will enter into the discontinuous conduction mode of operation at out power of 5W. (2 Marks)

(e) For the calculated conditions in 6(d), draw the waveforms for the parameters specified in 6(a). (3 Marks).

Q-8 A fly back converter is operating at a duty ratio of 0.3. the transistor "ON" state drop is 1 volt. The diode "ON" state drop is 0.7 V. the resistance of the inductor winding is 0.5 ohm and 0.25 ohm for the primary and secondary respectively. The input voltage of the converter is 30 V, the turns ratio of the transformer is 1 (primary) : 0.5 (secondary), the resistance of the load is 20 ohms. The converter is operating in magnetization mode (equivalent to continuous conduction mode). For this specification find out voltage conversion ratio (3 marks) and the efficiency of the converter (3 marks).