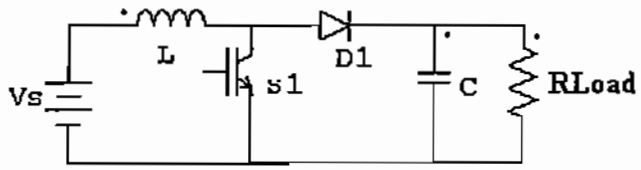
EEL209 Power Electronics
Major Test

Max marks: 40
Date and Time: 30/4/2008 8:00-10:00 hrs
Venue: II-337

1. State TRUE or FALSE and give reasons: **(5x2=10 marks)**
a. A GTO is rated for 6 kV and 4 kA. While turning it off, a gate current of - 40A will be needed.
b. If we compare an IGBT and IGCT (Integrated Gate Commutated Thyristor), The IGCT has better characteristics in terms of gate requirements, reverse blocking eapability and overall power rating.
c. The purpose of using two sets of 12-pulse thyristorised converters in HVDC system is to increase the voltage level at the DC side.
d. Power BJTs are extremely suitable for operating in parallel while being employed for circuits with higher current ratings.
e. A linear regulated power supply of a particular rating normally has a better efficiency than a Switched mode power supply (SMPS) of similar rating.

2. A flood-lighting system is installed in a cricket stadium where the intensity of lights has to be varied from 50% to 100%. The supply available is single-phase 230V 50Hz. The bulbs are of 150W capacity. What kind of a power electronie controller be employed for this purpose? What should be the ratings of the devices that are to be used? What should be the range of firing angle? **(4 marks)**

3. Consider a boost converter supplying 5A to a 60 V output with the input voltage being 50 V. L=65 μH. What should be the minimum switching frequency ($f_{sw\text{-}min}$) for the induetor current to be continuous? Assume now switching frequency = 1.1* $f_{sw\text{-}min}$. At this frequeney what should be the duty ratio? Calculate the maximum and minimum eurrent through the inductors. If the inductance value is decreased to 50 μH with the frequency being maintained at the same value, what will be the maximum inductor current? **(6 marks)**



4. A single-phase diode bridge rectifier is supplied by a 50V 50Hz AC source to feed a DC load taking a level current of 60 Amp. Determine the DC output voltage if (a) the supply has an inductance of 0.1 mH (ii) if the supply induetance is negligible but each diode has a forward drop of 0.6 V (iii) if the supply has a source resistance of 0.002Ω (assuming that the source induetance and diode drops are negligible). Draw the waveforms of the supply voltage, supply current, DC output voltage and current in each of these cases. What would be the power factor (from the mains side) in each of these cases? **(7 marks)**

5. Consider a three-phase voltage source inverter with star connected load working under 180 degree conduction mode. Draw the waveforms of phase and line voltages across the load and also the load current. How will the DC side current waveform be for an R-L load? Derive the expression for rms output voltage (per phase). If the input voltage is 100V, how much will be the rms value of output voltage per-phase? How will you go about calculating the peak value of the fundamental component of this voltage waveform? **(8 marks)**

6. For constructing a 3-phase to 3-phase cyclo-converter circuit that changes the frequency from 50 Hz to 16.666 Hz how many thyristors (minimum number) will be nceded? Show such a circuit topology. **(5 marks)**