Name: **Student Number:**

1. What are the *disadvantages* of switch-mode power electronics amplifiers compared to linear amplifiers?

2. Express the Pole A duty ratio, d_A, in terms of the control voltage, $v_{c,A}$ and the peak of the triangular voltage, $V_{tri,pk}$.

3. In a two-quadrant single-pole converter of dc bus voltage V_d=100V, fed by a **generator** of back emf $\boldsymbol{E_a}$**=45V** and armature resistance R_a=0.25 Ω, calculate the output pole voltage V_{AN} and the duty ratio d_A when pulling an armature current I_a=20A.

4. In a four-quadrant two-pole converter of dc bus voltage V_d=100V, supplied by a **generator** of back emf $\boldsymbol{E_a}$**=-75V** (spinning in reverse) and armature resistance R_a=0.5 Ω, calculate the output pole voltage V_{AB} and the duty ratio d when pulling an armature current I_a=10A.

5. Calculate the peak-peak armature current ripple in the above generating question when armature inductance L_a=1mH and the triangular frequency f_{tri}=10 kHz?

6. Sketch a synchronous buck converter.

7. A buck converter, switching at 1 MHz, powers a 1.5 V, 100 mA microprocessor from 3.0 V. Calculate the inductance required to limit the current ripple to +/- 10 %.

8. Calculate the capacitance required in the above converter to reduce the output voltage ripple to +/- 20 mV.

9. What are the peak and rms currents in the above inductor?

10. What are the rms currents in the controlled switched and the input capacitor on the 3V dc bus?

11. A three-phase sinusoidal PWM inverter is required to output 400 V line-line. What is the minimum dc bus voltage required?

12. A sinusoidal PWM full bridge inverter is required to output single phase 100 V in Japan. What is the minimum dc bus voltage required?