Subject: Power electronic (EE3410E) – Problems

1. **Design converter with the parameters as following:**

- Input : 48VDC± 15%
- Output : 12V, 5A with the ripple of voltage is ±2%
- Switching frequency: 100 kHz

a) Design the topology of converter, explain the operating principle of converter.

b) Calculate the essential parameters, choose the MOSFET, diode, and other device on the circuit.

(Guide: When design the output inductor and capacitor should choose: $\Delta I=30\%I_{out}$. And the $\Delta U=1\%U_{out.}$)

2. **Design a PWM single phase full-bridge inverter with the parameters as following:**
    - Output voltage: 220V RMS/ 50Hz;
    - Output power: 1000W, power factor: 0.85;
    - PWM frequency: 10 kHz

a) Calculate the required input DC voltage.

b) Calculate the output current.

c) Calculate the essential parameters to choose IGBTs and diodes.

d) Calculate the essential parameters of the output filter.

e) Calculate the essential parameters to choose the DC capacitor to keep the DC voltage ripple less than 5%.

3. **Design a three phase inverter control by SPWM method with the parameters as following:**
    - Output voltage: 3x380V/50Hz
    - Output power: 5kW, power factor: 0.85
    - PWM switching frequency: 10 kHz

a) Calculate the required input DC voltage.

b) Calculate the output current.

c) Calculate the essential parameters to choose IGBTs and diodes.

d) Calculate the essential parameters of the output filter.

e) Calculate the essential parameters to choose the DC capacitor to keep the DC voltage ripple less than 5%.

4. **The three phase inverter control by SVM method with the parameters as following:**
    - Input DC voltage: 450V
    - Load: Za=Zb=Zc=10+10j, in Star Connection (Y).
    - Switching frequency: 10 kHz
    - Output voltage fundamental frequency: 50Hz

a) Output voltage vector: $U_0 = 250e^{j\theta}$, $\theta = 2\pi * 50 * t\ (rad)$. Calculate the applied time for each vector when the $\theta = 30^0$. Sketch the control pulse waveform in this case.

b) Output voltage $U_0 = \left[U_\alpha, U_\beta\right]^T = [150,80]^T$. Calculate the applied time for each vector and sketch the control pulse waveform in this case.