

Part III

1.

a. Draw the circuit diagram of a **buck converter** with ideal components and derive the relationship between input voltage and output voltage in **continuous conduction mode**.

(10 marks)

b. Explain the selection of Inductor and capacitor values deriving necessary equations.

(06 marks)

c. A buck regulator has an input voltage of 12 V the required output is 5 V at 500 Ω . Peak to peak output ripple voltage is 20 mV. If the switching frequency is 25 kHz and peak to peak ripple current of the inductor is 0.8 A determine the following.

- i. The duty cycle (D).
- ii. Filter inductance (L).
- iii. Filter capacitance (C).

(09 marks)

2.

a. In a single phase inverter with unipolar modulation, a switching frequency (f_{sw}) is 300 Hz and $V_{dc} = 200$ V, $f = 50$ Hz. If the duty cycles for the first half cycles are 0.2, 0.6, and 0.2.

- i. Sketch the output voltage.
- ii. Find the rms value of the output voltage
- iii. Assuming $R=0$ and $L=1$ mH, sketch the current waveform for the first cycle (load current $i_{out(0)} = -1$).

(06 marks)

b. Describe **any** modulation strategy used in inverters.

(07 marks)

c. Describe the following terms related to inverters

- i. Multi-level inverter
- ii. Single phase inverter
- iii. Bipolar modulation
- iv. Pulse width modulation

(12 marks)

