

**Uva Wellassa University of Sri Lanka**  
**Faculty of Science and Technology**  
**Department of Science and Technology**  
**300 Level 2<sup>nd</sup> Semester Examination – Dec / Jan 2018**  
**SCT 376-2 Power Electronics**



**Instructions to candidates**

**Duration:** Two (02) hours.

**Number of questions:** Four (04) Essay Questions.

**Mark allocation:** 100 marks.

Answer **all** questions.

1.
  - a. State the Difference between **Linear Electronics** and **Power Electronics** and mention the advantages and applications of power electronics.

(05 marks)
  - b. Write down the characteristics of an **ideal diode**.

(03 marks)
  - c. Sketch the characteristic curve of a **Silicon-Controlled Rectifier (SCR)** and explain operational states, turn on and turn off methods.

(05 marks)
  - d. Briefly explain **three (03)** applications of a SCR with necessary circuit diagrams.

(12 marks)
  
2.
  - a. Describe the advantages of **switched mode power supplies** over linear power supplies.

(03 marks)
  - b. 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**.

(08 marks)
  - c. Explain the selection of Inductor and capacitor values deriving necessary equations.

(06 marks)
  - d. A buck regulator has an input voltage of 12 V the required output is 5 V at 500  $\Omega$ . 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).

(08 marks)



3.

- a. Explain the operation of a **Boost converter** with necessary diagrams. (10 marks)
- b. Draw the waveform patterns of a Boost converter in **continuous conduction mode** for the following. (04 marks)
- i. Voltage across inductor
  - ii. Output current
  - iii. Inductor current
  - iv. Capacitor current
- c. Describe the difference between **continuous conduction mode (CCM)** and **discontinuous conduction mode (DCM)** and their advantages and drawbacks. (06 marks)
- d. Derive the equation for the relationship between input voltage and the output voltage of a boost converter in **discontinuous conduction mode**. (05 marks)

4.

- a. Write down **three (03)** applications that require DC-AC conversion. (03 marks)
- b. 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. (05 marks)
- i. Sketch the output voltage.
  - ii. Find the RMS value of output voltage
  - iii. Assuming  $R=0$  and  $L=1$  mH, sketch the current waveform for the first cycle (load current  $i_{out(0)} = -1$ ).
- c. Describe **any** modulation strategy used in inverters. (05 marks)
- d. Describe the following terms related to inverters (12 marks)
- i. Multi-level inverter
  - ii. Single phase inverter
  - iii. Bipolar modulation
  - iv. Pulse width modulation

