Uva Wellassa University, Sri Lanka
End Semester Examination – January 2010
ENG 404-2 Power Electronics

Time: Two (02) hours

Total 04 Questions
Answer **All** Questions

01)

I. Draw a block diagram and explain switching mode power spply. What are the main advantages of switching mode power supply over transformer power supply?

(10 marks)

II. What is pulse width modulation? Explain techniques that can be used to generate pulse width modulated signal.

(10 marks)

III. Draw the circuit diagram of a Buck Converter with ideal components.

(10 marks)

IV. Draw the wave form patterns for the followings for a Buck Converter in Continuous Conduction mode at steady state. (With ideal components)

a) voltage across the inductor
b) output current
c) inductor current
d) capacitor current

(30 marks)

V. Derive the relationship between the input voltage and output voltage for the above converter in continuous conduction mode.

(20 marks)

VI. Derive equations and explain how you can select Inductor and Capacitors values for the above converter.

(20 marks)

02)

I. What is a Buck Boost Converter? Draw the circuit diagram with ideal components and explain its operation.

(20 marks)

II. Derive the equation for the relationship between input voltage and output voltage for the above converter in **Continuous Conduction Mode**.

(20 marks)

III. Draw the wave form patterns for the followings for a Buck Boost Converter in **Discontinuous Conduction Mode** at steady state. (With ideal components)

a) voltage across the inductor

b) output current

c) diode current

(20 marks)

IV. Derive the equation for the relationship between input voltage and output voltage for the above converter in Discontinuous Conduction Mode.

(20 marks)

V. Derive the requirement for the above converter to operate in Continuous Conduction Mode.

(20 marks)

03)

I. What is isolated DC –DC converter. Draw a block diagram and explain.

(20 marks)

II. What are the main differences between Fly Back Converter and Forward Converter?

(20 marks)

III. Draw the circuit diagram of a Fly Back Converter and explain its operation when the transistor switch is on and off.

(20 marks)

IV. Derive the relationship between input voltage and output voltage for the above converter at steady state.

(20 marks)

V. Explain how the inductance of the transformer effect switching device of the Fly back Converter.

(20 marks)

04)

I. State three applications that require DC-AC conversion.

(10 marks)

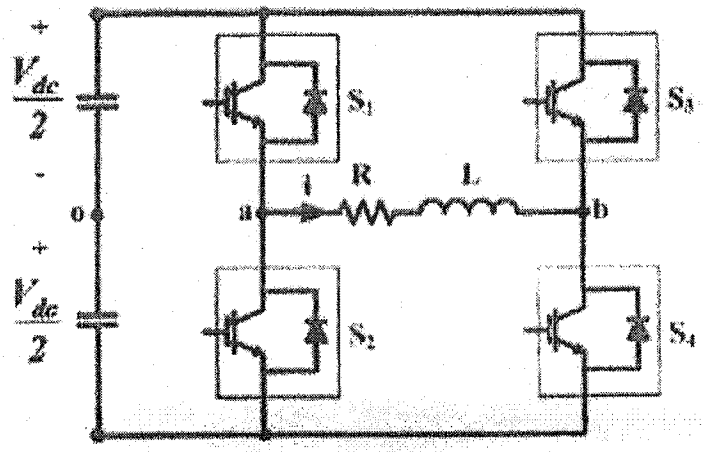
II. What is Sinusoidal Pulse Width Modulation? Explain why it is widely used in DC – AC Conversion circuits?

(20marks)

III. What are the main differences between Bipolar and Unipolar Modulation in a Single Phase Inverter? Explain it with output voltage wave patterns.

(20marks)

IV. Single Phase inverter is shown in the following figure.



S_1	S_3	$v_{ao}(t)$	$v_{bo}(t)$	$v_{ab}(t)$
0	0			
0	1			
1	0			
1	1			

a) Complete the given table with corresponding voltage value for each of the switching pattern.

b) For the bipolar operation of the above inverter redraw the circuit diagram and draw the current path for each of the corresponding switching pattern when i>0 and i<0.

c) Draw the output voltage and current wave forms for the above case.

(30marks)

V) Explain the effect of the frequency on the output voltage in a Single Phase Bipolar Inverter.

(20marks)