Uva Wellassa University, Sri Lanka
End Semester Examination – March 2011
SCT 464-2 Power Electronics

Time: Two (02) hours

Total 04 Questions
Answer **All** Questions

01)

I. Explain why thyristors are superior to other power devices?

(10 marks)

II. Using a current and voltage relationship explain operation of a Silicon Controlled Rectifier (SCR)?

(10 marks)

III. Explain following terms for a SCR.

a) Forward break over voltage.
b) Reverse break down voltage.
c) Holding current.
d) Latching current.

(20 marks)

IV. Explain two transistor model for a SCR.

(20 marks)

V. Explain how SCR can be turned on. What are the methods that a SCR can be accidently turned on.

(20 marks)

VI. Explain natural commutation and forced commutation methods that are used to turn off a SCR?

(20 marks)

02)

I. What is a Buck 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. Derive the requirement for the above converter to operate in Continuous Conduction Mode.

(30 marks)

IV. A Buck converter operates in continuous conduction mode. Find L and C values that make sure converter is in the Continuous Conduction Mode when load varies from 1 W to 10 W.

V_{in}= 100V; f_{sw}=10kHz; V_{out}= 10V; Δv=1%; 1 watt <P_{laod}< 10 watt

(30 marks)

03)

I. Draw the circuit diagram of a Buck converter with real components and explain how it differ from the Buck converter with ideal components

(20 marks)

II. Derive the equation for the voltage across the inductor and the capacitor current for the above converter in steady state?

(20 marks)

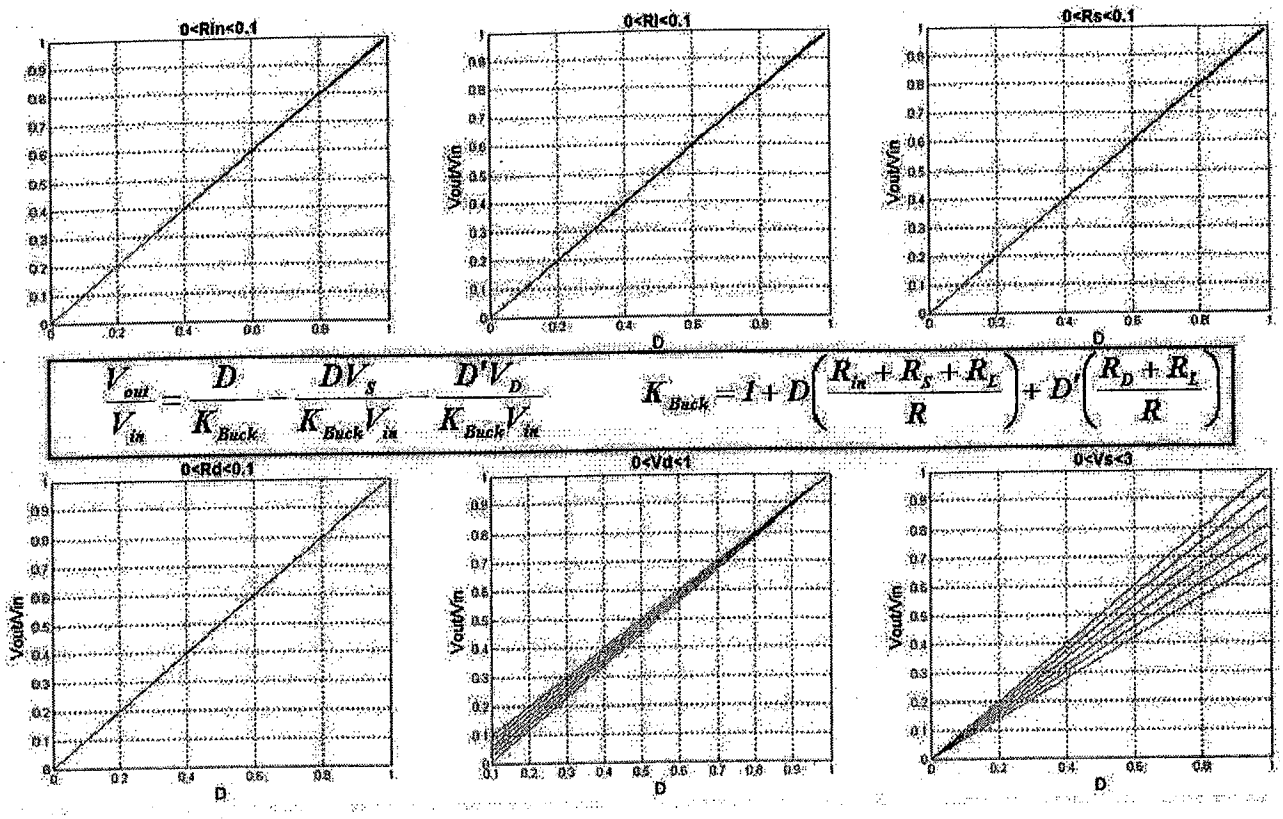
III. Derive the equation for the relationship between input voltage and output voltage for the above converter in Continuous Conduction Mode.

(20 marks)

IV. Following graphs shows characteristics of a buck converter with real components where input voltage (V_{in}) is 10 V and load resistance (R) is 10 Ω. Briefly explain them.

(40 marks)

R_{in} = Input resistance of the input voltage.
R_l = Internal resistance of the inductor.
R_s = Internal resistance of the switching device.
V_s = Voltage drop across the switching device.
V_d = Voltage drop across the diode.
R_d = Internal resistance of the diode.



04)

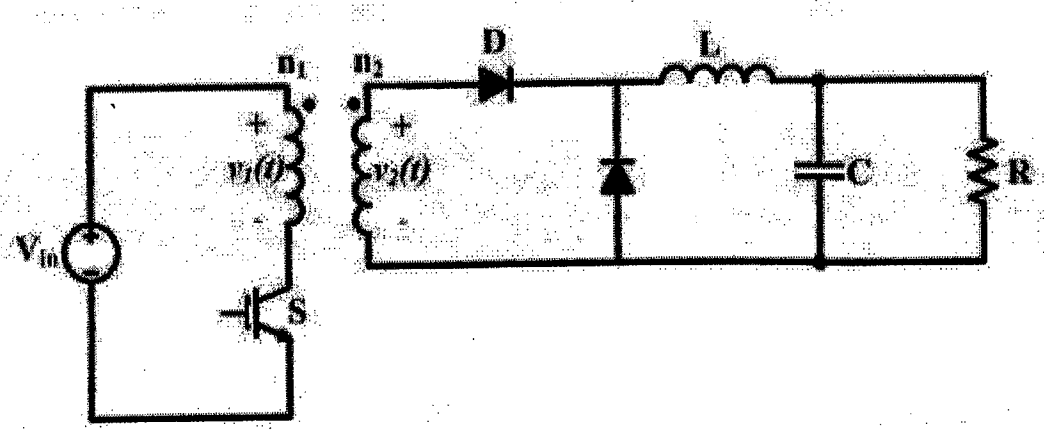
I. What is isolated DC –DC converter. Draw a block diagram and explain.

(20 marks)

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

(20 marks)

III. Circuit diagram of a Forward Converter is shown in following figure .Explain its operation when the transistor switch is on and off.



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(20 marks)

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

(20 marks)

V. Prove that that the maximum value for the Duty factor (D) for the above convert should satisfy following criteria.

$$D \leq \frac{1}{1+\left(\frac{n_3}{n_1}\right)}$$

(20 marks)