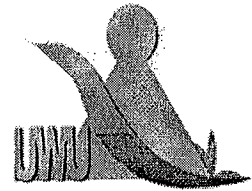




Uva Wellassa University, Sri Lanka
End Semester Examination – February/March 2012
SCT 464-2 Power Electronics



Time: Two (02) hours

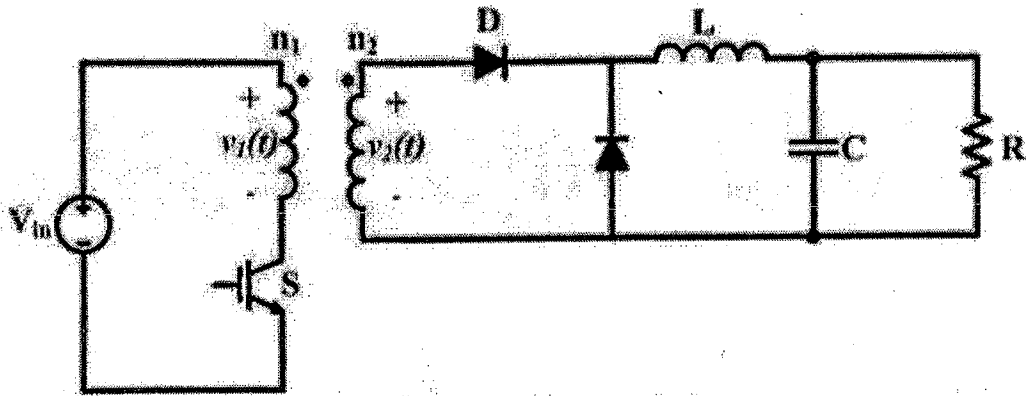
Total 04 Questions
Answer All Questions

01)

- I. Draw a block diagram and explain operation of a switching mode power supply. 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 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 the following figure. Explain its operation when the transistor switch is on and off.



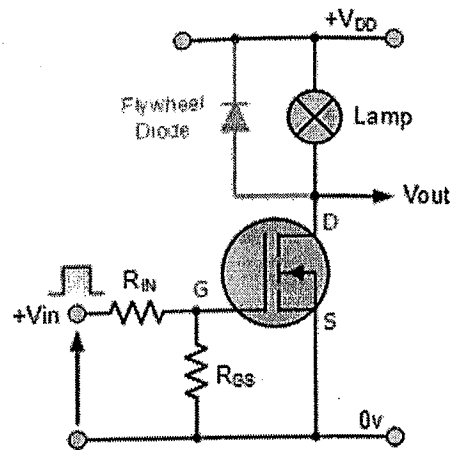
- IV. Derive the relationship between input voltage and output voltage for the above converter at steady state. (20 marks)
- V. Prove that that the maximum value for the Duty factor (D) for the above convert should satisfy following criteria.

$$D \leq \frac{I}{1 + \left(\frac{n_2}{n_1}\right)}$$

(20 mark)

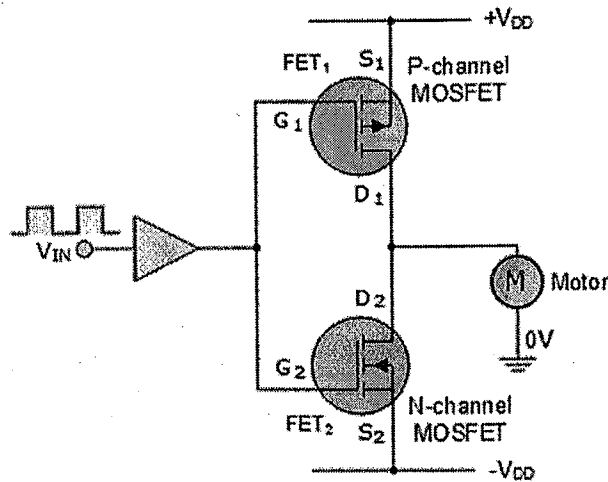
03)

- I. Briefly discuss the advantages of MOSFETs over BJTs and explain the characteristics of MOSFET by using suitable diagram. (30 marks)
- II. Following figure shows operation of a MOSFET in switching mode. Assume that the lamp is rated at 6V, 24W and is fully "ON", the standard MOSFET has a channel "ON-resistance" ($R_{DS(on)}$) value of 0.1Ω .



- i) Calculate the power dissipated in the MOSFET switch.
 - ii) Explain the usage of "Flywheel Diode" if the lamp is replaced by an inductive load.
- (30 marks)

III. Explain the combined operation of the following two MOSFET's to change the rotational direction of the motor.



(40 marks)

04)

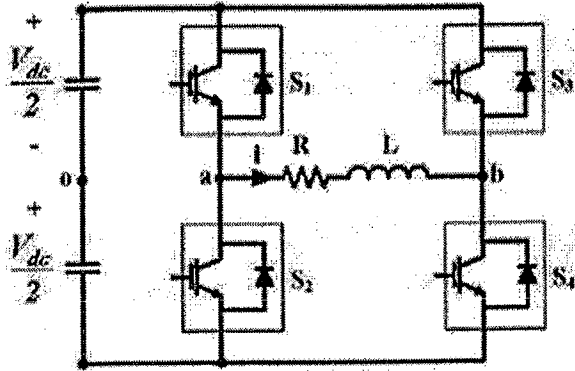
- I. State three applications that require DC-AC conversion.
- (10 marks)
- II. What is Sinusoidal Pulse Width Modulation? Explain why it is widely used in DC - AC Conversion circuits?

(20 marks)

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

(20 marks)

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			

- Complete the given table with corresponding voltage value for each of the switching pattern.
- 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 $i < 0$.
- Draw the output voltage and current wave forms for the above case.

(30 marks)

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

(20 marks)