

Department of Electrical Engineering
Jamia Millia Islamia, New Delhi.
Power Electronics –EES- 502
(B. Tech-V Sem) (1st Sessional Test)- Sep 2016

Time One Hour

Maximum Marks: 30

- Note:
- i) Answer all questions.
 - ii) Only scientific calculator is allowed.

Question No.1: Answer the following questions

(5 x 2)

- I. Explain the difference between controlled and uncontrolled switch?
- II. Draw the schematic and waveform of half wave RC firing Circuit?
- III. Explain the difference between SCR and TRIAC?
- IV. A 12 phase uncontrolled rectifier is connected to load and the rms value of input phase voltage is 230V, calculate the average output voltage?
- V. Define the terms Ripple Factor and THD?

Question No.2: Solve the following questions.

(2 x 5)

- I. A diode circuit shown in Fig. 1 with $R = 20 \text{ Ohm}$, $L = 10 \text{ mH}$. If a load current of 20 A is flowing through freewheeling diode D_m and switch S is closed at $t=0$, determine the expression for the current through the switch S .

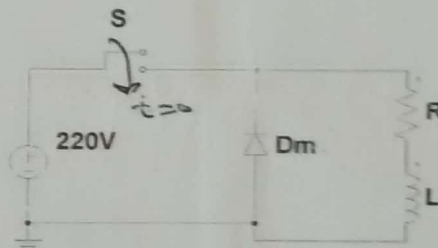
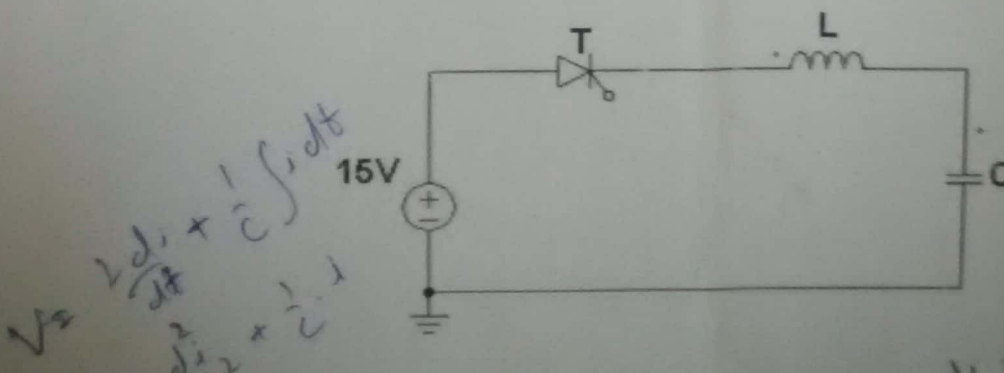


Fig. 1

- II. What is commutation circuit? List types of commutation circuit? Explain working of any one with schematic and diagram.

Question No.3: Thyristor T in the figure 2 below is initially off and is triggered with a single pulse of width $10 \mu\text{s}$. It is given that $L = (100/\pi) \mu\text{H}$ and $C = (100/\pi) \mu\text{F}$. Assuming latching and holding currents of the thyristor are both zero and the initial charge on C is zero, Find out the conduction time of SCR T. (1x 10)



Power Electronics (EES-502)

IIth sem

Department of Electrical Engg

- Note: (i) Attempt all the questions.
(ii) Calculator is allowed.

Q-1-

(2x5)

- (a) what are the ideal characteristics of electric switches?
- (b) Explain reverse recovery time of diode?
- (c) what is the difference between Controlled, uncontrolled and semi Controlled Switch?
- (d) In the circuit shown in fig.1, a pure inductor L is connected with diode D and AC source. Draw the current waveform of diode D .

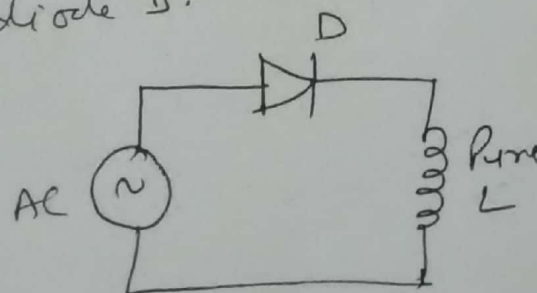


Fig.1.

- (e) Draw the symbol & V-I characteristic of IGBT.

Fig ① of ③

Q.2

- (a) Consider a phase Controlled Converter (3X2) shown in Fig. 2. The thyristor is fired at an angle α in every positive half cycle of the input voltage. If the peak value of the instantaneous output voltage equal 230V, calculate the firing angle α .

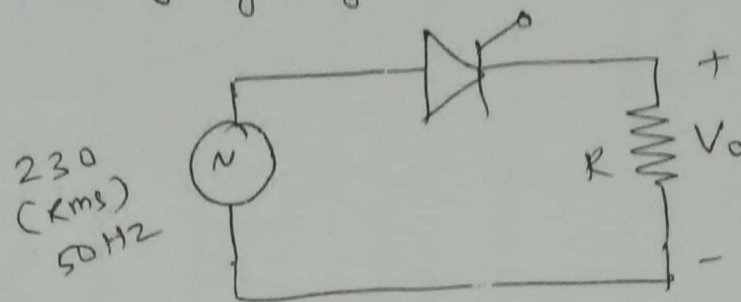


Fig. 2.

- (b) Explain the working of UJT Firing circuit for SCR with schematic, waveform?

Q.3

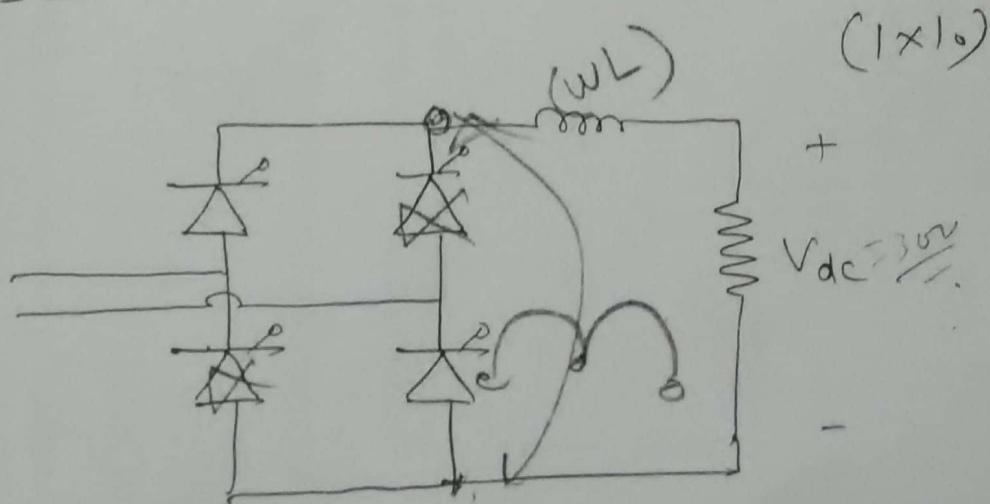


Fig. 3.

Fig ② of ③

The ~~Fig~~ Controlled Thyristor Converter is shown in fig. 3, is fed from a single phase source. When the firing angle is 0° , the dc output voltage of the converter is 300V. What will be the output voltage for a firing angle of 60° , assuming continuous conduction?

———— The Ccd —————>

Department of Electrical Engineering
Jamia Millia Islamia, New Delhi.
Power Electronics –EES- 502
(B. Tech- Vth Sem) (1st Sessional Test)

Sept 2014

Time One Hour

Maximum Marks: 30

- Note:
- i) Answer all questions.
 - ii) Only scientific calculator is allowed.

Question No.1: Answer the following questions

(5 x 2)

- What are the ideal characteristics of an electrical switch? Explain with signal diagrams?
- What is reverse recovery time of diode? Explain reverse recovery time of Schottky diodes?
- Explain the difference between GTO and TRIAC?
- A 7 phase uncontrolled rectifier is connected to load and the rms value of input phase voltage is 230V, calculate the average output voltage?
- Define the terms THD and Crest Factor?

Question No.2: Solve the following questions.

(2 x 5)

- A diode circuit shown in Fig. 1 with $R = 10 \text{ Ohm}$, $L = 5 \text{ mH}$. If a load current of 10 A is flowing through freewheeling diode D_m and switch S is closed at $t=0$, determine the expression for the current through the switch S .

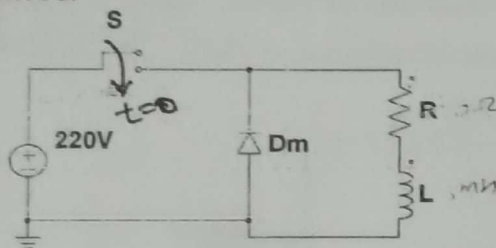


Fig. 1

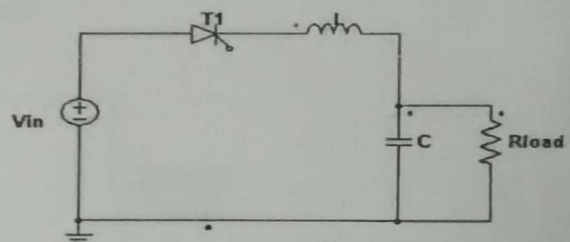


Fig. 2

- Identify the circuit shown in Fig. 2. Explain its working with waveforms and mathematical expression?

Question No.3: Given the circuit of Fig. 3, $V_p = 250 \sin(\omega t)$, Transformer has 1:1 ratio, find the following: (1 x 10)

- (a) – Avg Output voltage, (b)– Rms output voltage, (c)– The rectification efficiency, (d)– The Form Factor, (e)– The Ripple Factor (f)– The TUF, (g)– The PIV of any diode, (h)– The crest factor of the input current.

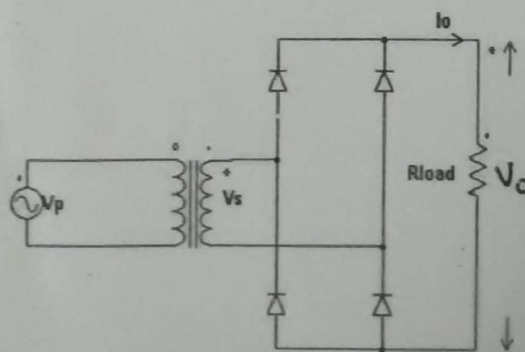


Fig. 3

Department of Electrical Engineering
Ist Sessional Test
EES-502: Power Electronics
Vth Semester

Time: 1 Hour

Sept 2013

Note: Attempt all questions.

M.M.: 15

Q.1: (A) - Define the following term with expressions: [2]

(a)- Total Harmonic Distortion (b)- Rectification Efficiency.

√(B) – Explain the difference between general purpose, fast recovery and schottkey diodes. [3]

Q.2: Explain the working of RC firing circuit with schematic and waveforms? What advantage it has over R firing circuit? [5]

Q.3:

(A) Draw the input voltage, current, output voltage current waveforms of the circuit shown in Fig.1. Explain for how much duration the diode D1 will conduct and why? Initial conditions are zero. [3]

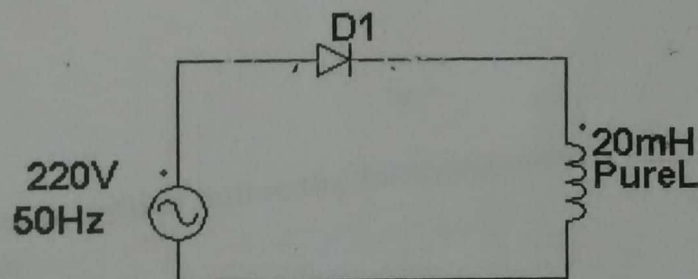


Fig.1

(B) Explain with circuit diagram, whether freewheeling diode is required in the case of full bridge diode rectifier with R-L load? [2]

Attempt any three question.

- Q1. Describe the reverse recovery characteristic of a diode with proper diagram showing reverse recovery time. [10]
- Q2. Describe the working of RC firing circuit for thyristor with schematic and waveforms. What advantage it has over R firing scheme. [10]
- Q3. Draw the waveforms of Voltage and current across the thyristor T1 and across resistive load as shown in the schematic of Fig. 1. The typical forward breakover voltage of thyristor T1 is 800V. [10]

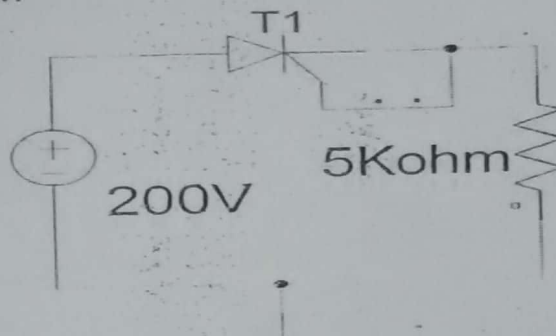


Fig. A.

- Q4. For a single phase rectifier define the following terms: [10]
- a)- Form Factor
 - b)- Rectification efficiency
 - c)- Ripple Factor
 - d)- Crest Factor.

M.M: 30

TIME: 1 Hour

Note: Attempt All Questions

Q-1

(2x5)

- (a) Draw the Schematic of Buck-Boost DC-DC converter.
- (b) What is the difference between resonant & PWM Inverter.
- (c) Which method is more suitable to control duty cycle, by varying frequency or on time of signal.
- (d) Draw the gating scheme of 3-phase voltage source bridge inverter operating in 180° conduction mode. (Draw only gate waveform).

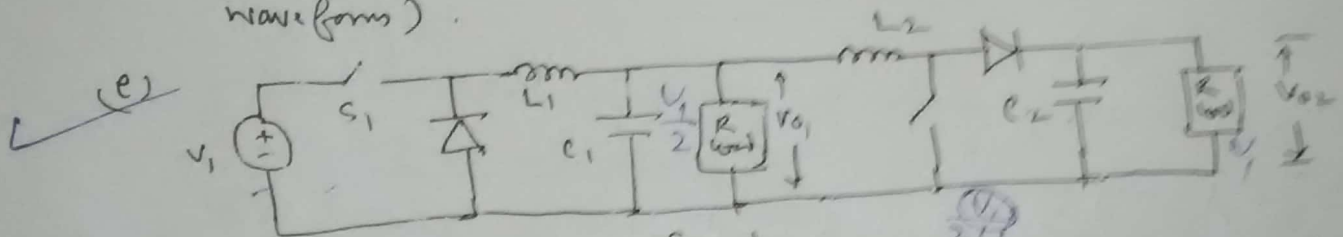


Fig. 1.

What is the value of V_{02} in terms of V_1 if S_1, S_2 operates at 50% duty cycle in Fig. 1.

(5x2)

Q-2

- (a) In Fig. 2, a step down DC-DC converter switched at 1 KHz, with a duty cycle of 0.5. What is the peak to peak ripple load current.

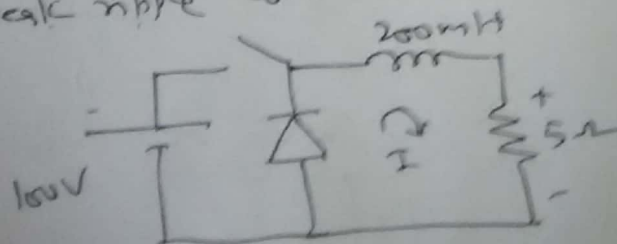


Fig. 2 -

- ✓ (b) A single phase voltage source inverter is feeding a purely inductive load, as shown in fig 3. The inverter is operated at 50 Hz. in 180° degree square wave mode. Assume that the load current does not have any dc component. Calculate the peak value of the inductor current i_o .

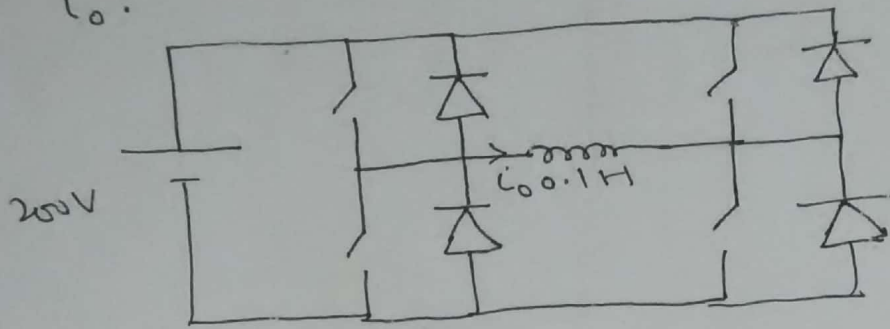


Fig. 3.

- Q-3. A DC-DC converter employed to charge a battery (1x10) as shown in fig-4. The charging current is 5 A. The duty cycle is 0.2. The chopper output voltage is also shown in the fig 4. Calculate peak to peak ripple current in the charging current.

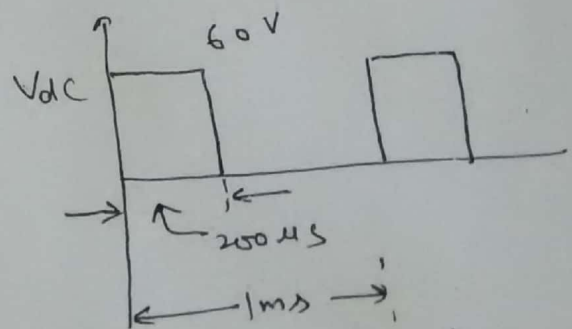
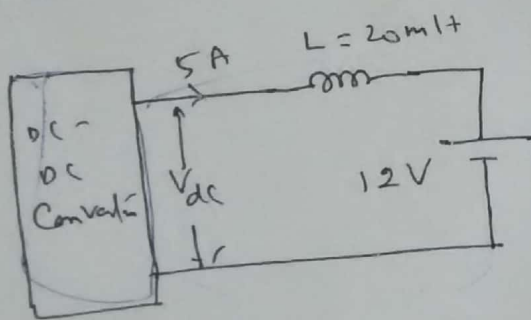


Fig. 4.

$$V_{rms} = \sqrt{\frac{1}{T} \int_0^T v^2 dt}$$

$$20 \times 10^{-3} = \frac{V_{in} d (1-d)}{2 \times f \times I_L}$$

$$\frac{20 \times 10^{-3} \times 10}{60 \times 0.2 \times 0.8} = \frac{1}{f}$$

$$\frac{2}{12 \times 8} = \frac{8 \times 12}{2}$$

$$0.5 = \frac{12 \times 48 \times 12}{60 \times 10^3 \times 20 \times 10^{-3}}$$

$$\left(\frac{12}{25} \right)^2$$

$$(10^3)$$

2nd SESSIONAL TEST

EES-502 : POWER ELECTRONICS

5th SEM

Nov 2015

M.M. 30

Time: 1 Hour

NOTE: Attempt all questions.

Q-1-

(2x5)

(i) A single phase half bridge inverter has input voltage of 48 VDC. Inverter is feeding a load of 2.4Ω . What is the rms output voltage at fundamental frequency.

(ii) What is the difference between buck, boost & buck-boost DC-DC Converter.

(iii) Based on the no. of phase, which type of inverter is suitable for better performance and why? Explain.

(iv) Explain the working of single phase full wave ~~inverter~~ inverter with R-L load.

(v) Calculate the output voltage V_o of Fig. 1.

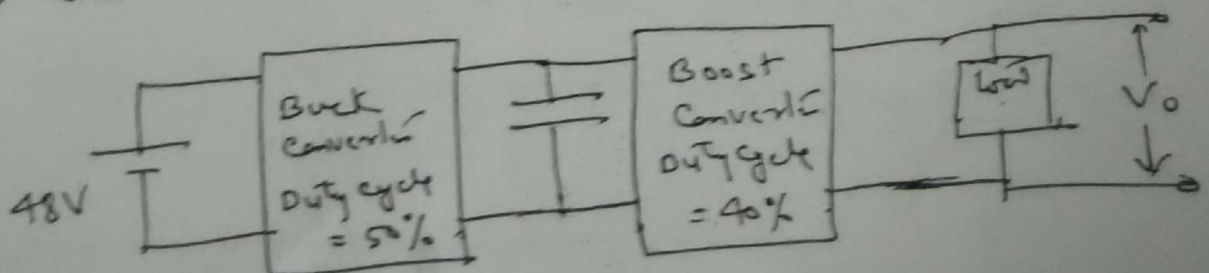


Fig. 1.

(i) The output voltage of single phase inverter is shown in fig. 2. It is periodic.

Calculate the rms fundamental component of the output voltage for conduction angle $\alpha = 120^\circ$.

The max value = +1
min value = -1

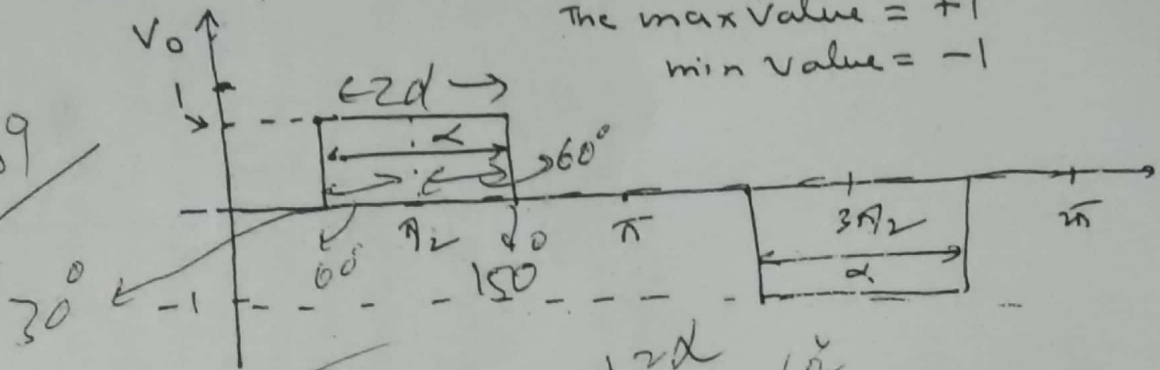


Fig. 2 2α 2α $2\alpha/2$ $2\alpha/2$ $2\alpha/2$ $2\alpha/2$

(ii) Fig 3 shows a dc-dc converter operating from a 100V dc input. The duty ratio of the main switch S is 0.8. The load is sufficiently inductive so that the load current is ripple free. Calculate the average current through the diode D under steady state.

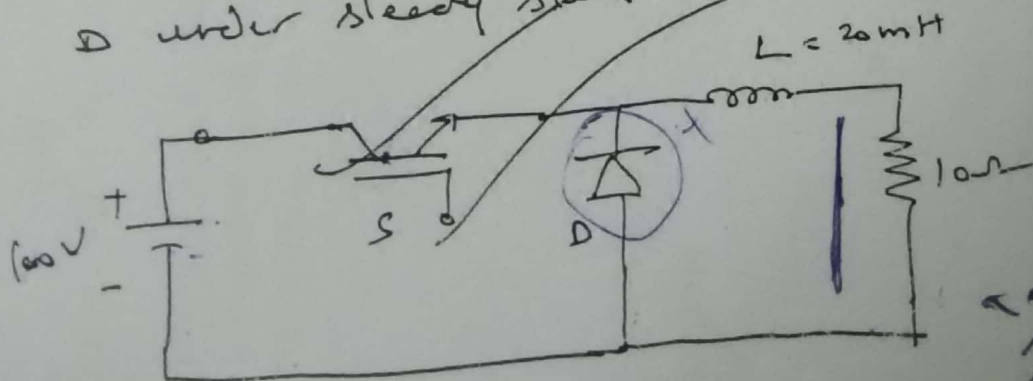


Fig. 3.

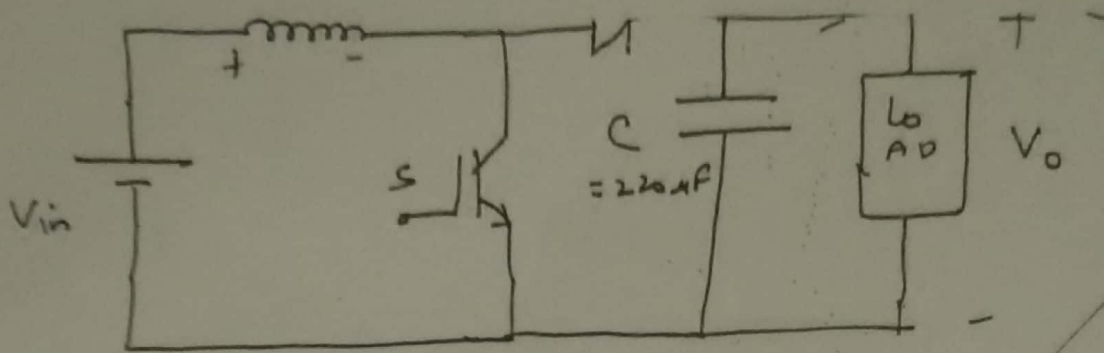


Fig. 4.

In Fig. 4, $V_{in} = 5V$, the average output voltage $V_0 = 15V$ and the average load current $I_0 = 0.5A$. The switching frequency of Switch S is 25 KHz . $L = 150 \mu H$, $C = 220 \mu F$. Calculate:

(a) Duty cycle -

(b) The ripple current of Inductor ΔI

(c) The peak current of Inductor

(d) the ripple voltage of filter capacitor ΔV_C

$$\Delta V_C = \frac{V_0}{2fC}$$

$$\Delta I = \frac{V_0}{2fL}$$

Department of Electrical Engineering
Jamia Millia Islamia, New Delhi.
Power Electronics – EES- 502
(B. Tech) – Vth Sem-(IInd Sessional Test)

Oct 2014

Time One Hour

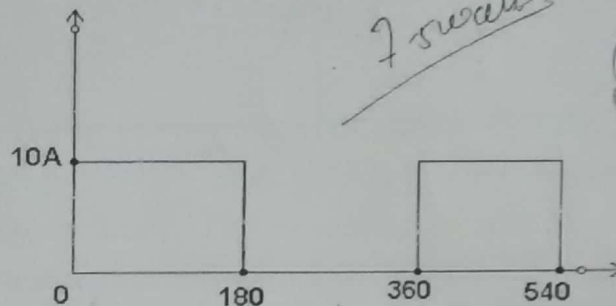
Maximum Marks: 30

- Note:
- i) Answer all questions.
 - ii) Only scientific calculator is allowed.

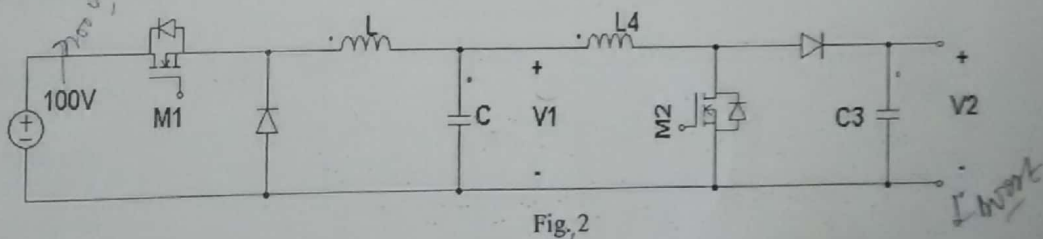
Question No.1: Answer the following questions

(5 x 2)

- I. Explain the difference between the current source and voltage source inverter?
- II. A single phase full bridge inverter has a resistive load $R = 2.4 \text{ ohm}$ and the dc input voltage is 48V . Determine (a) The rms output voltage at the fundamental frequency (b) the output power.
- III. A single phase full bridge inverter is connected with highly inductive load. Is it required to connect the freewheeling diode? Explain with schematic.
- IV. A MOSFET is rated for 10A , carries a periodic current as shown in Fig. 1. The ON state resistance of the MOSFET is 0.15 ohm . What is the average ON state loss in the MOSFET?



- V. In Fig 2 both the switches M1 and M2 are operating at 50% duty cycle. Find the value of V_1 and V_2 under steady state?



Question No.2: Solve the following questions.

(2 x 5)

1. The DC – DC converter of Fig. 3 has the average output voltage $V_2 = 15\text{V}$. The average load current $I_{load} = 0.5 \text{ A}$. The switching frequency is 20 kHz . If $L = 250\mu\text{H}$, $C = 440\mu\text{F}$, determine (a) the duty cycle (b) the inductor ripple current (c) the inductor peak current (d) the capacitor ripple voltage.

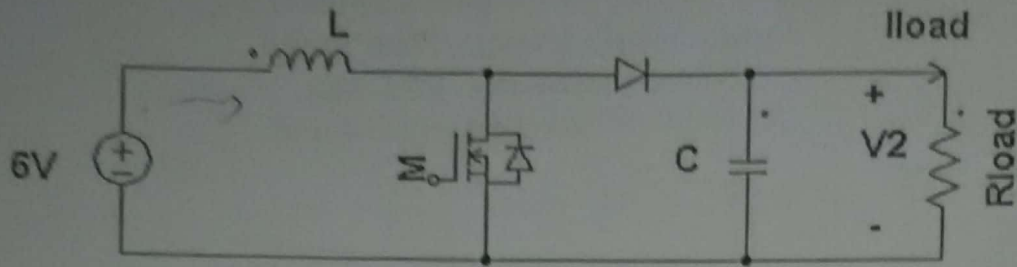


Fig. 2

2. A single phase voltage source inverter is operated in 180 degree, 50 Hz square wave mode shown in Fig. 3. The load is highly inductive. Assume that load current does not have any dc component, calculate the peak value of inductor current I .

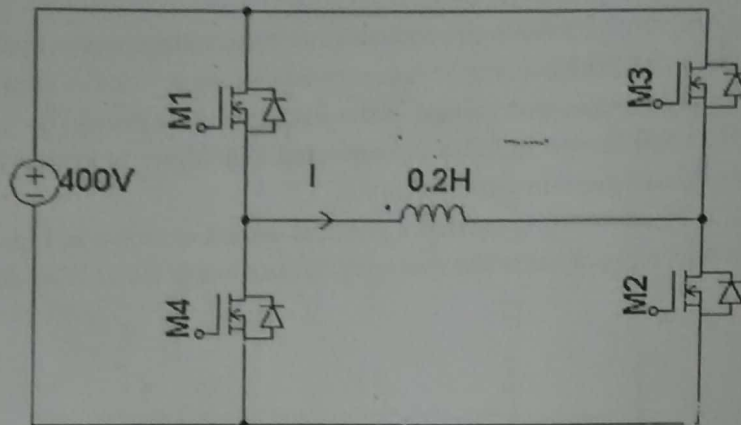


Fig. 3

Question No.3:

(1x10)

A DC - DC converter is connected with a 3 phase inverter operating in 180 degree conduction mode, as shown in Fig. 4. The three phase balanced resistive load is connected. The duty cycle of the switch S is 50%. Determine under steady state: (a)- The rms value of the load phase voltage. (b)- The power consumed by the 3 phase load.

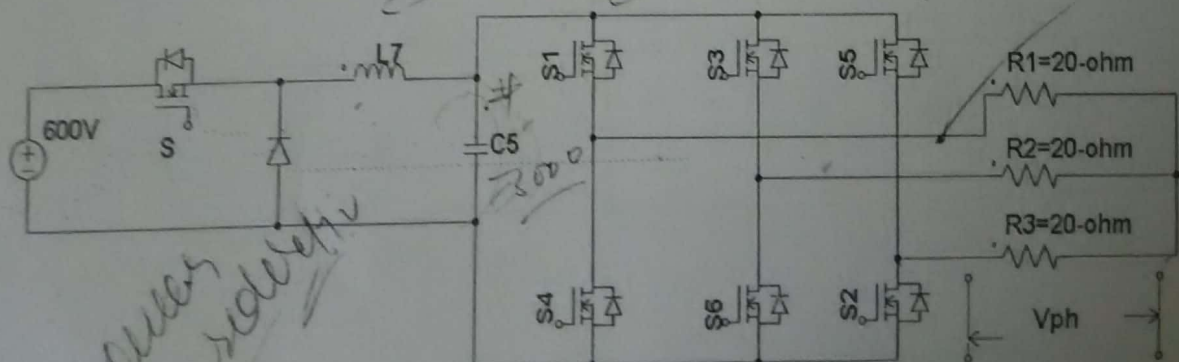


Fig. 4

Department of Electrical Engineering
IInd Sessional Test
EES-502: Power Electronics
Vth Semester

Time: 1 Hour

Note: Attempt any three questions.

Oct 2013

M.M.: 15

Q.1: Explain the working of single phase full bridge controlled inverter with resistive load drawing schematic, waveforms and giving the equation of output voltage? [5]

Q.2: The single phase half bridge inverter has a resistive load of $R = 2.4 \text{ ohm}$ and the dc input voltage is 48V. Calculate: [5]

(a) - the rms output voltage at the fundamental frequency.

(b) - The output power.

Q.3: Explain the working of buck dc-dc converter with schematic, waveform and expressions? [5]

Q.4: The circuit shown in Fig. (1) has an input voltage of 12V. The required average output voltage $V_a = 5V$ at $R = 500 \text{ ohm}$ and the peak to peak output ripple voltage is 20mV. The switching frequency is 25 kHz. If the peak to peak ripple current of inductor is limited to 0.8 A, determine: [5]

(a)- The duty cycle

(b)- The inductor L

(c)- The Capacitor C

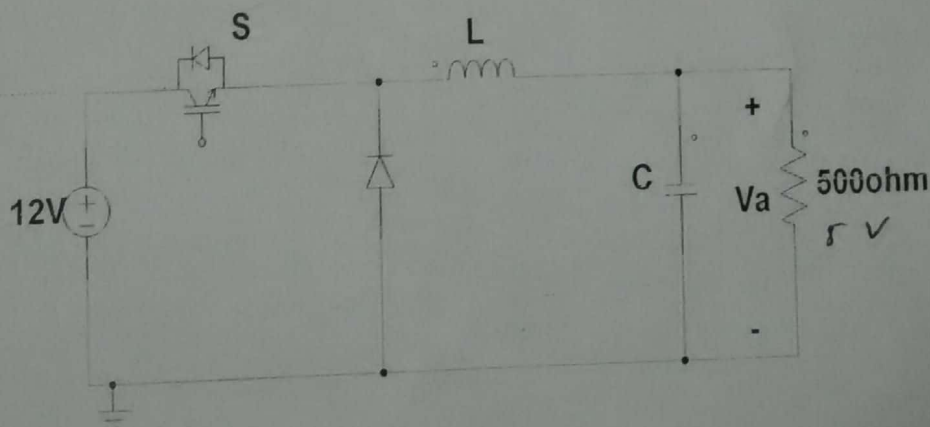


Fig (1)

Department of Electrical Engineering
B.Tech. (Electrical Engg.)- V Semester

Sessional Test-II

Power Electronics-(EES-502)

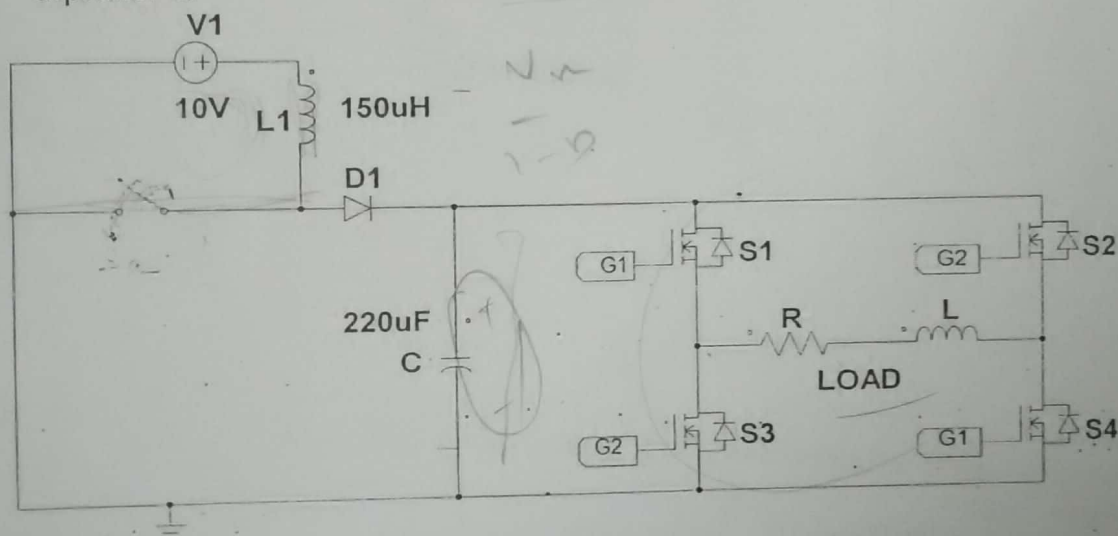
Oct-Nov, 2012

Time: 1 Hour

Max Marks: 30

Attempt any three question.

- Q1. Describe the working of 3 phase voltage source bridge inverter connected with 3 phase resistive load R- star connected in 180° conduction mode with schematic, waveforms and mathematical expressions. [10]
- Q2. Draw the schematic of step down converter with R-L load? Explain its working with waveforms? Derive the expression for load inductor current without making linear approximation? [10]
- Q3. Identify the circuit shown in Fig. A. Explain its working with waveforms and expressions. If the ON time of switch S_a is $10\mu\text{s}$ and OFF time is $15\mu\text{s}$, find out the voltage across the capacitor C. [10]



- Q4. List the classification of DC-DC choppers? Explain any two of them with schematic and Waveforms? [10]