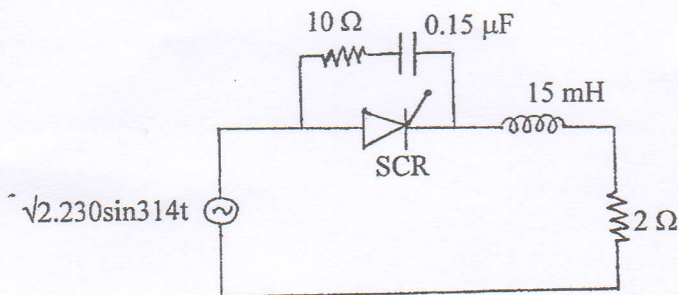


Exam.	Back		
	Level	BE	Full Marks
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

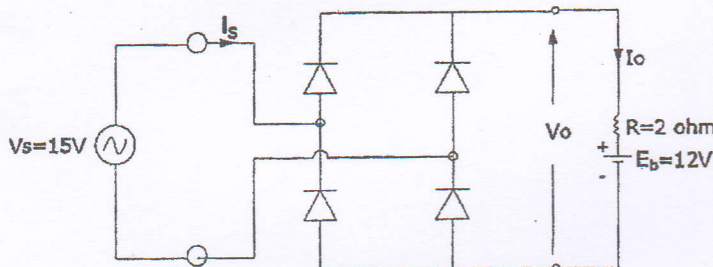
**Subject: - Power Electronics (EE701)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. a) Explain how a transistor can be used as static switch. Also explain base signal generating circuit for transistor switch.
- b) For the circuit shown in below:
  - i) Calculate the maximum value of  $di/dt$  and  $dv/dt$  of the SCR
  - ii) Find the RMS and average current rating of SCR for firing angle delays of  $90^\circ$



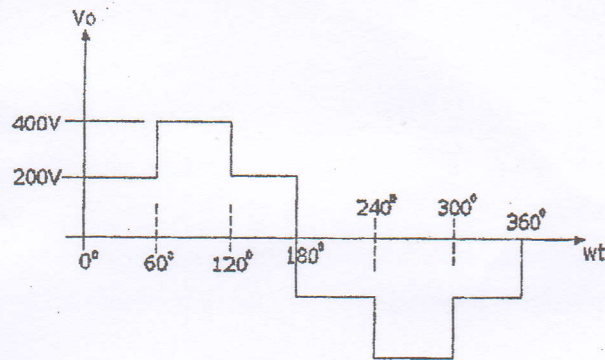
2. a) In figure below shows a full-wave rectifier circuit used to charge at 12 V battery through a 2  $\Omega$  resistor.



Calculate:

- i) Average value of charging current
  - ii) Power supplied to the battery
  - iii) Gross output power from rectifier
  - iv) Additional resistance to be connected in series with 2  $\Omega$  resistors to limit the average value of charging current to 0.5 amp.
- b) Explain the operation of three-phase single way-controlled rectifier circuit with necessary waveforms. Also derive the expression for average value of the output voltage.

3. a) Determine the average value of output voltage and the fundamental component of the load current of step down chopper having input voltage of 220V DC, load resistance  $20 \Omega$  and duty cycle of 45% Given: chopping frequency of chopper is 1 kHz.
- b) Explain the operation of single PWM techniques for inverter control and therefore determine the rms value of output voltage.
4. a) Explain the operation of a single phase current source inverter with ac motor as load.
- b) In figure below shows the waveform of output voltage (per phase) of three phase inverter. Calculate RMS value and fundamental component of the output voltage.



5. a) With mathematical aid, explain how full converters can be used for reverse power flow in bipolar link of HVDC transmission.
- b) Explain the operation of ac voltage controller and its application in electronic load controller for Micro-Hydro power plant.

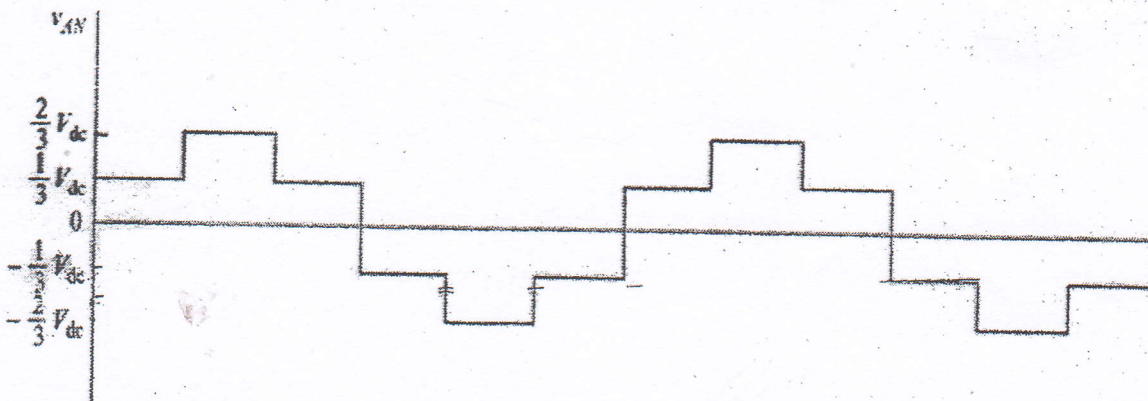
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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Power Electronics (EE701)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. a) Explain the V-I characteristics of a thyristor. Also explain a thyristor firing circuit.  
b) Explain the  $dv/dt$  protection and  $di/dt$  protection methods for a thyristor.
2. a) Draw the circuit diagram of single phase full converter with highly inductive load and explain its operation. If the load current is constant at 15A, draw the waveform of input as current and calculate the fundamental component of the input ac current.  
b) A single phase fullwave rectifier charges a battery from a single phase supply of 230 V, 50 Hz. The battery has interval emf of 200 volt and its internal resistance is 0.5 ohm. Calculate:
  - i) Average value of charging current
  - ii) Power supplied to the battery
  - iii) Gross power output from the rectifier
  - iv) Additional resistance to be connected in series to reduce the charging current by 30%
3. a) Explain the operation of step up dc chopper.  
b) Draw the circuit diagram of Type-E four quadrant chopper and explain its operation for all four quadrants.
4. a) The given waveform in figure below is the output voltage and three phase inverter. Calculate the fundamental component and 3<sup>rd</sup> harmonic component of the output voltage.



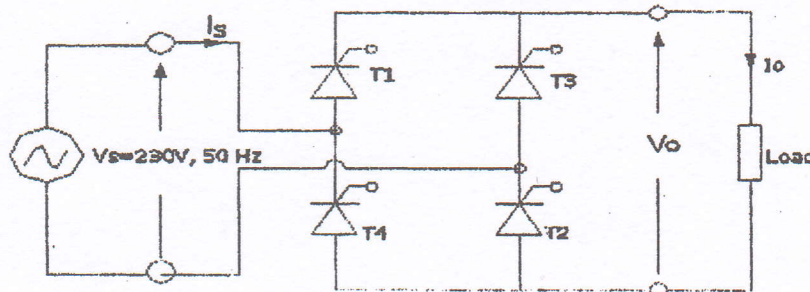
- b) The single phase ac controller has input voltage of 230V, 50Hz and the positive and negative thyristors are triggered at an angle of  $90^\circ$  and  $\pi+90^\circ$  respectively. The series RL load has  $R = 20 \Omega$ ,  $L = 50\text{mH}$  then determine the rms value of load voltage and load current.
5. a) Explain the operation of single phase cyclo-converter. What are its applications?  
b) Explain the series connection of two single phase full converter with necessary circuit diagram and waveforms. How these series connected circuit can be operated in

Exam.	Back		
Level	BE	Full Marks	80
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Power Electronics (EE701)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) Discuss a method of thyristor turn ON mechanism. Also explain about thyristor force commutation techniques. [8]
- b) Explain how a transistor can be used as a power switch. [8]
2. a) Figure shows a single phase full converter circuit with highly inductive load so that load current is constant and equal to 25 amp. Explain its operation for firing angle =  $30^\circ$ . Draw the waveforms of input voltage  $V_s$ , output voltage  $V_o$  and input current  $i_s$ . Calculate the fundamental component of input current and Input power factor. [8]



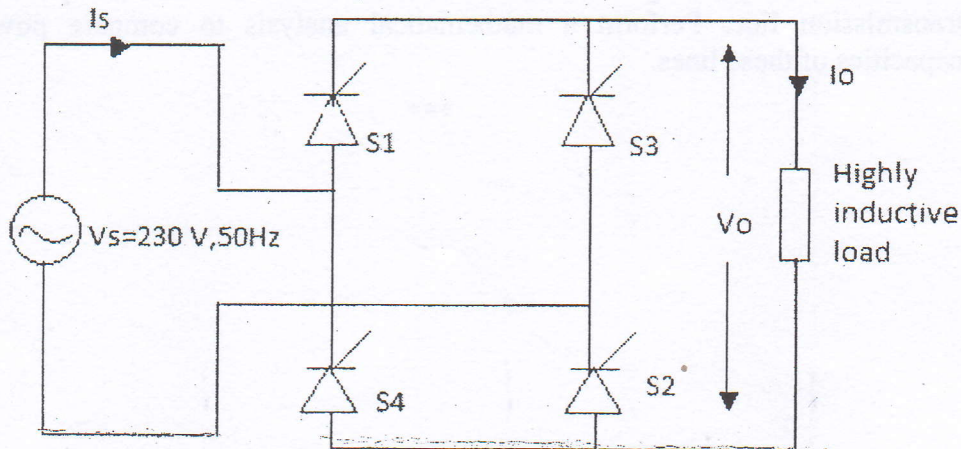
- b) Explain the operation of three-phase single way rectifier with diode with neat circuit diagram and waveforms. Derive the expression for average and rms values of the output voltage. [8]
3. a) Explain the operation of three phase AC to DC conversion using three Thyristors. Draw the input and output voltage waveform and find average and rms value of output voltage expression from the obtained waveform. Assume highly inductive load. [8]
- b) Explain the operation of step up chopper. Derive the expression for the average and rms value of output voltage. [8]
4. a) Explain the operation of single phase PWM inverter. Derive the expression for rms value of output voltage and also write down the output voltage in the form of Fourier expression. [10]
- b) With the help of suitable circuit diagram and waveform, explain the operation of single phase cycloconverter. [6]
5. a) Explain the operation of ac voltage controller and its application in electronic load controller for micro hydro plant. [8]
- b) Explain the series connection of two single phase full converter with necessary circuit diagram and waveforms. How these series connected circuit can be operated in rectification mode and inversion mode? [8]

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject: - Power Electronics (EE701)**

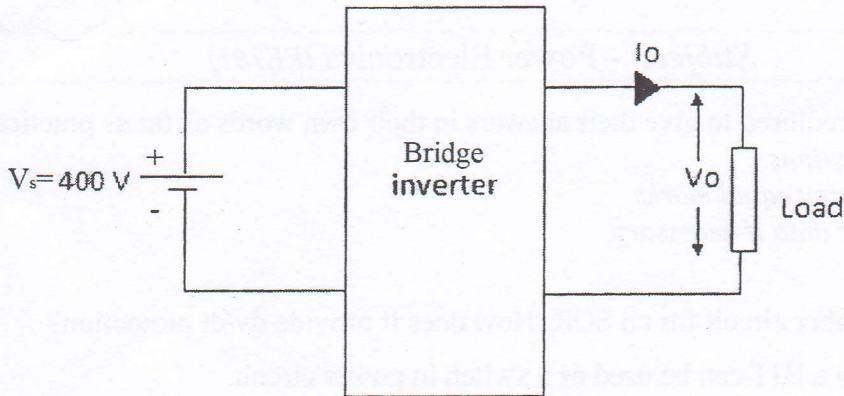
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
- ✓ **All** questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. a) Draw a snubber circuit for an SCR. How does it provide  $dv/dt$  protection?  
 b) Explain how a BJT can be used as a switch in power circuit.
2. a) The average value of output voltage of single phase full converter with 4 GTO switches is controlled by extinction angle control method. The load current is constant and equal to 20Amp due to highly inductive load. For the extinction angle of  $30^\circ$ , draw the waveforms of load voltage, load current and input ac current. Also find RMS value of output voltage, magnitude and phase of fundamental component of the input ac current.



- b) Explain the operation of three phase single way controlled rectifier with thyristor with neat diagram and waveforms. Derive the expression for average and RMS value of the output voltage.
3. a) Explain the operation of a step down chopper with dc motor as load.  
 b) With the help of suitable circuit diagram explain  $180^\circ$  conduction mode of three phase inverter? And also draw the output waveforms of instantaneous phase and line voltage for star connected load.

4. a) A single phase full bridge inverter with dc input voltage of  $V_s=400V$  and generating output square wave of 50Hz is connected to inductive load having  $R=10\ \Omega$  and  $L=50mH$ . Calculate the magnitude and phase of fundamental component and third harmonic component of output voltage and load current.



- b) Explain the operation of ac voltage controller with purely resistive load. Also explain the use of ac voltage controller in ELC
5. a) With the help of suitable circuit diagram, describe the operation of reversible power flow on DC line.
- b) What are the advantages of HVDC transmission line with compare the HVAC transmission line. Perform a mathematical analysis to compare power transfer capacities of these lines.

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