

**GUJARAT TECHNOLOGICAL UNIVERSITY**

M.E Sem-I Regular Examination January / February 2011

Subject code: 712902N

Subject Name: Power Processing Circuits

Date: 01 /02 /2011

Time: 02.30 pm – 05.00 pm

Total Marks: 70

**Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Notations used have usual meaning.

- Q.1** (a) Describe construction & working of IGBT in brief. Draw its characteristic. Also compare it with MOSFET. **07**
- (b) The waveforms of transistor switch are shown in Fig. 1 **07**

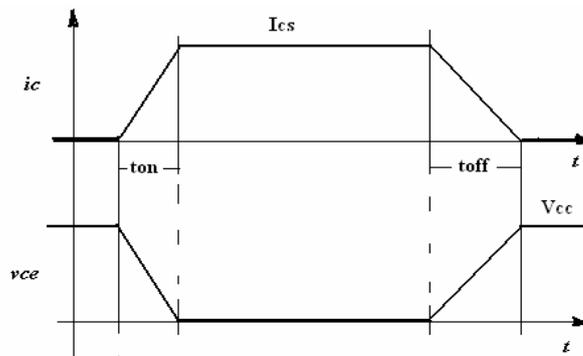


Fig. 1

The parameters are  $V_{cc}=220V$ ,  $I_{cs}=10$  Amp,  $t_{on}=2.5 \mu\text{sec}$ ,  $t_{off}=6 \mu\text{sec}$ ,  $f_s=1$  kHz. Determine the power loss due to collector current

- (1) during turn on
- (2) during turn off

- Q.2** (a) Explain How power factor becomes poor due to presence of harmonics in waveform. **07**
- (b) A single phase semi converter bridge is fed at 230 Vac, 50 Hz supply. Find **07**
- (1) average output voltage
  - (2) rms output voltage
  - (3) harmonic factor
  - (4) input power factor
- If firing angle is  $90^\circ$ . Assume constant output current  $I$  and ideal transformer.

**OR**

- (b) A single phase fully controlled bridge converter feeds an R-L load. The input voltage is 230 Vac, 50 Hz supply to the converter. The firing angle is  $30^\circ$ . The load current is constant at 10 Amp. Find **07**
- (1) Dc output voltage of the converter
  - (2) rms value of input current
  - (3) displacement factor
  - (4) input power factor
  - (5) harmonic factor.

- Q.3** (a) Compare three phase converters and single phase converters. Explain three phase half wave converter with resistive load. Draw necessary waveforms. **07**
- (b) Explain ramp firing scheme for single phase converter circuits with waveforms. **07**

**OR**

- Q.3 (a)** Discuss effect of source inductance on converter operation. Obtain equivalent RE model. **07**
- (b)** Explain four quadrant operation of converter. **07**
- Q.4 (a)** Explain DC to DC boost converter operation in discontinuous mode. **07**
- (b)** Explain single phase bridge type cyclo-converter. Draw necessary waveforms. **07**  
Discuss how variation in rms value and frequency of the voltage can be obtained.

**OR**

- Q.4 (a)** Explain Full bridge type DC to DC converter. **07**
- (b)** Discuss single phase AC controller. What will be the effect of load inductance on controller operation? Deduce an expression of output voltage for single phase AC controller feeding to resistive load. **07**
- Q.5 (a)** Explain single pulse width modulation technique for inverter. Also show that selective harmonics can be eliminated from the inverter output using single pulse width modulation technique. **07**
- (b)** A DC to DC buck converter operates at a frequency of 1 khz from a 100 Vdc source supplying an R=10 ohms. The converter consists of L=50 mH. If the average output voltage is 50 Vdc, Find **07**  
(1) Duty cycle (2) rms value of load voltage (3) the average value of load current (4) I<sub>max</sub> and I<sub>min</sub>.  
Also comment on the converter operation, if the value of inductance or frequency is increased.

**OR**

- Q.5 (a)** Describe harmonics reduction techniques used for inverter circuit in brief. **07**
- (b)** Explain 120° conduction mode operation of three phase basic inverter circuit. **07**  
Also draw phase to neutral voltage and phase to phase voltage for Y connected load.

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