



RN-6825

**B. E. - III (Sem. V) (Instrumentation & Control)  
Examination  
May / June - 2010  
Power Electronics**

Time : 3 Hours]

[Total Marks : 100

**Instructions :**

(1)

नीचे दृशविवेक निशान्चीवाणी विगतो उत्तरवडी पर अवश्य लपवी.  
Fillup strictly the details of signs on your answer book.

Name of the Examination :  
**B. E. - 3 (Sem. 5) (I & C)**

Name of the Subject :  
**Power Electronics**

Subject Code No. : **6 8 2 5** Section No. (1, 2,.....): **1&2**

Seat No. :

Student's Signature

- (2) Attempt all questions.  
(3) Figures to the right indicates full marks.  
(4) Answer of two sections must be written in separate answer books.

**SECTION - I**

- Q-1(A) Give the answers in brief (10)
- 1 The switching power loss in case of semiconductor devices varies linearly with 1  
(a) switching frequency  
(b) switching time ( $T_{c(on)}$  and  $T_{c(off)}$ )  
(c) switching frequency and switching time  
(d) none
- 2 Secondary breakdown occurs in 1  
(A) MOSFET but not in BJT  
(B) Both MOSFET and BJT  
(C) BJT but not in MOSFET  
(D) None
- 3 Following semiconductor device has the voltage/current rating of 5000 volts/5000 Amp 1  
(a) GTO  
(b) Forced turn off thyristor  
(c) Power transistor  
(d) none of the above

- 4 Turn off gain of GTO compared to that of MCT is 1  
a) equal b) greater  
c) less d) greater or equal
- 5 The following semiconductor device can work upto 400 KHz 1  
a) MOSFET b) forced turn off thyrister  
c) MCT d) none of above
- 6 Turn off gain of GTO compared to that of MCT is 1  
a) equal b) greater  
c) less d) greater or equal
- 7 Define latching current of SCR. 2
- 8 Define holding current of SCR. 2
- (B) What is a snubber ckt? A thyristor operating from a peak supply (8)  
voltage of 400V has the following specifications:  
Repetitive peak current ( $I_p$ ) = 200A  
 $di/dt$  max = 50A/us  
 $dv/dt$  max = 200V/us  
safety factor = 2,  $\xi = 0.65$   
design a snubber ckt if minimum value of load resistance is 10 ohm.
- Q-2(A) With the help of ckt diagram and associated waveforms, explain 8  
resonant commutation
- (B) i) Explain the term derating. 4  
ii) 18 SCRs are connected in series. Calculate the values of R 4  
and C that will divide static and dynamic voltage equally.  
Maximum difference in off state leakage current = 1mA  
Maximum difference in reverse recovery charge = 30 $\mu$ C
- OR**
- Q-2(A) With the help of ckt diagram and associated waveforms, explain 8  
resonant commutation.
- (B) A thyristor string is formed by the series and parallel connection of 8  
thyristors. The voltage and current ratings of the string are 6 kV  
and 4 kA respectively. Available thyristors have the voltage and  
current rating of 1.2kV and 1kA respectively. The string efficiency  
is 90% for both series and parallel connections. calculate the  
number of thyristors to be connected in series and parallel.  
If the maximum blocking current is 15mA and  $\Delta Q_{max} =$   
25 $\mu$ C, calculate the values of R and C for series equalizing ckt.

- Q-3 **Give answers of any two** 16
- 1 Give cross sectional view of Triac and explain its turn ON process. Explain its V-I characteristics.
  - 2 Describe RC half wave trigger ckt for SCR and explain.
  - 3
    - i) Explain the constructional details of IGBT
    - ii) Define any four SCR current ratings.

**SECTION II**

- Q-4(A) **Give the answers in brief** (10)
- 1 For continuous conduction freewheeling diode conducts in a 1 phase semi converter each SCR conducts for 1  
 a)  $\alpha$             b)  $\pi - \alpha$             c)  $\pi$             d)  $\pi + \alpha$
  - 2 1 Each diode of three phase half wave diode rectifier conduct for 1  
 a)  $60^\circ$   
 b)  $120^\circ$   
 c)  $180^\circ$   
 d)  $90^\circ$
  - 3 In a 3 phase semi converter for firing angle less then or equal to  $60^\circ$ , each thyristor and diode conduct for respectively for 1  
 a)  $60^\circ, 60^\circ$   
 b)  $90^\circ, 30^\circ$   
 c)  $120^\circ, 120^\circ$   
 d) none
  - 4 The frequency of the ripple in the output voltage of 3-phase semi converter depends on 1  
 a) firing angle and load resistance  
 b) firing angle and load inductance  
 c) firing angle and supply frequency  
 d) Load circuit parameters.
  - 5 In a 1 phase full converter, the number of SCRs conducting during overlap is 1  
 a) 1            b) 2            c) 3            d) 4
  - 6 In a dual converter, converter 1 and 2 works as 1  
 a) 1 as rectifier, 2 as inverter.  
 b) Both as rectifier  
 c) Both as inverter  
 d) none
  - 7 Classify the converters 2
  - 8 Draw the diagram of four Quadrant chopper. 2
- Q4(B) Explain under what firing angle does the three phase semi converter works as a 6 pulse converter with suitable waveforms. 8

Q-5 (A) Describe the working of single phase Mid-type converter with RL load with a neat sketch. 8

(B) Describe different types of modes of operation employed in the practical dual converter with associated waveforms. 8

**OR**

Q-5 (A) Explain the effect of free wheeling diode in 1 phase full wave converter with associated waveforms. 8

(B) Draw the diagram of DC Jones Chopper with suitable waveforms. 8

**Q-6 Answer any two questions (16)**

(A) The input voltage is 230V, 50HZ, 1 pulse SCR is triggered at a firing angle of  $40^\circ$  and the load current extinguishes at an angle of  $210^\circ$ .

find,

- i) the circuit turn off time
- ii) Average output voltage ( $E_o$ )
- iii) Average load current for  $R=5\Omega$  and  $L=2mH$ .

(B) A 3-phase half wave controlled rectifier is supplied at 230v/ph, 50Hz, the source inductance and resistance being 1.2mH and  $0.05\Omega$  respectively. By assuming thyristor voltage drop =1.4v and continuous load current of 25A.

Find,

I) Average output voltage ( $E_o$ ) at  $0^\circ, 30^\circ, 45^\circ, 60^\circ$ ,

(C) A 3 phase fully controlled bridge rectifier is supplied at 230V/phase and at a frequency of 50 Hz. The source inductance  $L_s = 5 mH$  and load current on DC side is constant at 12A. if the load consists of a DC source voltage of 230V having an internal resistance of 0.9 ohm, find,

- i) firing angle
- ii) overlap angle