

DiplETE – ET (Current & New Scheme)

Time: 3 Hours

December 2016

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. During forward blocking state of SCR, the voltage and current respectively are _____.

- (A) high and high (B) low and low
(C) high and low (D) low and high

b. Each diode of 3 phase half wave rectifier conducts for _____

- (A) 600 (B) 1200
(C) 1800 (D) 900

c. Which of the following devices has metal-silicon junction?

- (A) schottky diode (B) general purpose power diode
(C) SCR (D) MOSFET

d. A thyristor needs protection against _____

- (A) high $\frac{dv}{dt}$ (B) high $\frac{di}{dt}$
(C) both high $\frac{dv}{dt}$ and high $\frac{di}{dt}$ (D) either high $\frac{dv}{dt}$ or high $\frac{di}{dt}$

e. The minimum value of anode current which an SCR must attain during turn on process to maintain conduction, when gate signal is removed, is known as:

- (A) Forward Leakage Current (B) Reverse leakage current
(C) Holding Current (D) Latching Current

f. A step down chopper has a duty cycle of 50% and a voltage of 20V is applied across it. The average output voltage will be equal to:

- (A) 5V (B) 10V
(C) 20V (D) 40V

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Subject: POWER ELECTRONICS

- g. The DIAC is primarily used as:
 (A) Power thyristor (B) Triggering device
 (C) Pulse generator (D) Surge protector
- h. The maximum anode current, gate being open at which an SCR is turned off from ON condition is called
 (A) cut off current (B) switch off
 (C) forward current (D) holding current
- i. When thyristors are connected in series and parallel it may be necessary to have _____
 (A) Current derating.
 (B) voltage derating.
 (C) Both current and voltage derating
 (D) None of these
- j. The function of snubber circuit connected across an SCR is to _____
 (A) suppress dv/dt .
 (B) increase dv/dt .
 (C) decrease dv/dt .
 (D) keep transient overvoltage at a constant value.

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

- Q.2** a. What are the various types of power electronics circuits? Explain briefly with their area of applications. (8)
- b. Discuss and compare the V-I characteristics of power diode and ideal diode. (8)
- Q.3** a. A Power MOSFET has $I_{DSS} = 2 \text{ mA}$, $R_{DS(ON)} = 0.3 \Omega$, duty cycle $d=50\%$, $I_D=6 \text{ A}$, $V_{DS} = 100 \text{ V}$, $t_r = 100 \text{ ns}$ and $t_f = 200 \text{ ns}$. If the frequency of switching is 40 KHz, then find
 (i) on-state loss (ii) off-state loss
 (iii) turn-on switching loss (iv) turn-off switching loss (8)
- b. What is an IGBT? Discuss the cross section and equivalent circuit of IGBT and give its applications. (8)
- Q.4** a. Explain two-transistor model of SCR with a neat circuit diagram. (6)
- b. A gate-triggering circuit for an SCR provides a train of pulses with a frequency of 100 Hz and a pulse width of 2 ms. If the pulse has a peak power of 2 W. Find the average power dissipated by the gate. (4)
- c. Explain the difference between holding current and latching current of a thyristor. (6)

- Q.5** a. What is a dual converter? Explain non circulating current type dual converter (8)
- b. Draw the circuit of Single Phase Full Wave Controlled Bridge Rectifier with RL load and briefly explain its working. (8)
- Q.6** a. A three phase half wave controlled rectifier is connected to a 220V source. If the delay angle is 45° and the load resistance $R = 10\Omega$, find
- (i) the average output current (ii) SCR average current
(iii) average power (iv) maximum reverse voltage (10)
- b. List out the industrial applications of Three-phase controlled rectifiers. (6)
- Q.7** a. What is a Buck-Boost Chopper? Draw its circuit configuration and explain its working with the help of voltage and current waveforms. (8)
- b. With the help of circuit diagram and waveforms explain the working of Step-down chopper. (8)
- Q.8** a. What is the necessity of pulse width modulated inverter? Draw the circuit diagram of single phase full-wave pulse-width modulated bridge inverter. Explain its working with output waveforms. (8)
- b. What are Ideal Current Source Inverters? How they are different from voltage source inverters. (8)
- Q.9** a. Explain the operation of a single phase cycloconverter with the help of input output voltage waveforms. (8)
- b. What is a Static Switch? What are its various types? What are the advantages of static switches over mechanical switches? (8)