

DiplETE – ET

Time: 3 Hours

DECEMBER 2013

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. The maximum anode current that an SCR can handle without destruction is called _____.

- (A) holding current (B) forward rating of SCR
(C) working current of an SCR (D) cutoff current

b. A UJT contains_____.

- (A) four pn junction (B) three pn junction
(C) two pn junction (D) one pn junction

c. The DIAC is primarily used as:

- (A) Power thyristor (B) Triggering device
(C) Pulse generator (D) Surge protector

d. In a controlled rectifier a freewheeling diode is necessary if the load is

- (A) inductive (B) resistive
(C) capacitive (D) any of these

e. The efficiency of a chopper circuit is above

- (A) 80 % or more (B) around 50 %
(C) around 20 % (D) around 5 %

f. In a series inverter supplying a load resistance R, the commutating elements L and C should be such that _____.

- (A) $R^2 = 4L/C$ (B) $R^2 < 4L/C$
(C) $R^2 > 4L/C$ (D) $R^2 < 2L/C$

Code: DE71

Subject: POWER ELECTRONICS

- g. A Cycloconverter can be _____.
- (A) step down (B) step up
(C) both (A) and (B) (D) neither (A) nor (B)
- h. A three phase fully controlled converter is a
- (A) 3 phase converter (B) 6 phase converter
(C) 2 phase converter (D) 12 phase converter
- i. A single phase full wave fully controlled bridge rectifier uses _____
- (A) 2 SCR (B) 3 SCR
(C) 4 SCR (D) 6 SCR
- j. 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

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

- Q.2** a. Why high frequency signals are not rectified by ordinary diodes but are rectified by Schottky diodes ? (5)
- b. What are the reverse current carriers? Why is the reverse current in a silicon diode much smaller in comparable to germanium diode? (5)
- c. Explain briefly how power loss occurs in transistor switch with the help of circuit diagram. (6)
- Q.3** a. Explain operation of UJT as a relaxation oscillator. (8)
- b. Draw and explain V-I characteristic of a power MOSFET. (8)
- Q.4** a. Why is pulse triggering generally preferred for thyristors? (4)
- b. Explain the difference between holding current and latching current of a thyristor. (6)
- c. A dc supply of 100V feeds an inductance of 10H through a thyristors. Find the minimum width of the gate pulse so that the thyristors is triggered. It is given that the latching current of thyristor is 80 mA. (6)
- Q.5** a. Explain the working of single phase full wave controlled rectifier with purely resistive load, using a centre tapped transformer feeding. Draw the voltage and current waveforms. (8)

- b. A three phase full converter is fed by 400V 3phase 50 Hz supply. The average load current is 100 A and load is highly inductive. If the firing angle is 60° . Find (i) output power P_{dc} (ii) average, rms and peak current through thyristors and (iii) peak inverse voltage. (8)
- Q.6** a. Draw the circuit of three phase half-wave controlled rectifier with an inductive load and a Freewheeling diode. Explain its working. (8)
- b. 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 (8)
- (i) the average output voltage
 - (ii) the average output current
 - (iii) the average SCR current
 - (iv) the SCR RMS current
- Q.7** a. Why should a current source inverter have a large inductance in series with the Source? (4)
- b. A series inverter circuit has an inductor of 10 mH, a capacitor of 47 μ F connected in series with load resistance of 5 Ω . Calculate (i) the resonance frequency and (ii) the time period of oscillation. (6)
- c. Explain the working of Half bridge voltage source Inverter. (6)
- Q.8** a. Explain the operation of a single phase cycloconverter with the help of input output voltage waveforms. (8)
- b. Explain the operation of static AC switch and list out its uses in power electronics. (8)
- Q.9** a. Draw the circuit of step-down chopper. Explain its operation for the ON state and OFF state. List out the industrial application of DC choppers. (8)
- b. A DC buck chopper operates at a frequency of 1KHZ from a 100V DC source supplying a 10 Ω resistive load. The inductive component of the load is 50 mH. If the average output voltage is 50V, find (8)
- (i) the duty cycle
 - (ii) the ON Period (T_{ON})
 - (iii) the RMS value of the load voltage and
 - (iv) the average value of the load current