ROLL NO. _____

Code: DE71 **Subject: POWER ELECT**

DipIETE – 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)** $R^2 < 2L/C$

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)** hoding 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 60^0. 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^o and the load resistance R = 10Ω 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 μF 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 10Ω 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