ROLL NO. _____

Code: DE71 **Subject: POWER ELECTRONICS**

DipIETE – ET (Current Scheme)

Time: 3 Hours **JUNE 2015** **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. Duty cycle d is defined as _____

(A) t_{ON}/T **(B)** T/ t_{ON}
(C) $t_{ON} + t_{OFF} / t_{OFF}$ **(D)** None of these

b. An ideal power semiconductor switch satisfies the following condition

(A) It turns ON or turns OFF in zero time
(B) When it is ON, the voltage drop across it is high
(C) When it is OFF, the current through it is not zero
(D) It dissipates maximum power

c. A snubber circuit is used to protect power diode against _____

(A) Overvoltage **(B)** Overcurrent
(C) Transients **(D)** All of these

d. MOSFET are connected in series to handle _____

(A) Higher voltage **(B)** Higher current
(C) Both A and B **(D)** None of these

e. A freewheeling diode is used in a controlled rectifier circuit in case of _____

(A) Resistive load **(B)** Inductive load
(C) Capacitive load **(D)** All types of load

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

(A) 60^0 **(B)** 120^0
(C) 180^0 **(D)** 90^0

g. Chopper frequency is given by _____

(A) $T_{ON} + T_{OFF}$ **(B)** T_{ON} / T_{OFF}
(C) $1/ T_{ON} + T_{OFF}$ **(D)** T_{OFF} / T_{ON}

h. In an UJT, maximum value of charging resistance is associated with _____

(A) Peak point
(B) Valley point
(C) any point between peak and valley point
(D) after the valley point

i. The di/dt rating of an SCR is specified for its _____

(A) Decaying anode current **(B)** Decaying gate current
(C) Rising gate current **(D)** Rising anode current

j. In a CSI, if the frequency of output voltage is f Hz, then frequency of voltage input to CSI is _____

(A) f **(B)** 2f
(C) f/2 **(D)** 3f

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. What is the advantage of two series connected power diodes with reverse bias? Draw its circuit diagram and explain its V-I characteristics. **(8)**

Q.3 a. What is IGBT? Draw the switching characteristics of IGBT. **(8)**

b. Explain the working principle of UJT with corresponding VI characteristics. **(8)**

Q.4 a. Explain why gate triggering is preferred over voltage triggering. **(8)**

b. What is natural commutation? What are its types? Classify the types by which the SCR can be turned off. **(8)**

Q.5 a. Explain with the help of a circuit diagram, the working principle of a single phase full wave half controlled bridge rectifier using two SCRs and two diodes. **(10)**

b. SCRs with peak forward voltage rating of 1000V and average on state current rating of 40 A are used in single phase midpoint converter and single phase bridge convertor. Find the power that these two converters can handle. Use a factor of safety of 2.5 **(6)**

Q.6 a. Explain with the help of circuit diagram, the working principle of three phase full wave full controlled bridge rectifier. **(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 = 10Ω, find
(i) the average output current (ii) SCR average current
(iii) average power (iv) maximum reverse voltage **(8)**

Q.7 a. What is a chopper? List out its various industrial applications. **(6)**

b. What is Step-Down chopper? Draw its circuit diagram and explain its operation for the ON state and OFF state. **(10)**

Q.8 a. A series Inverter circuit has an inductor of 10mH, a capacitor of 47μF connected in series with a load resistance of 5 Ω. Calculate (i) the resonance frequency (ii) the time period of oscillations. **(6)**

b. What is current source inverter? Draw the circuit of single-phase current source bridge inverter and explain its working with the help of load current waveform. **(10)**

Q.9 a. Explain with the help of block diagram, the working principle of three phase to single phase cycloconverter. **(8)**

b. Draw the circuit diagram for three phase static switching circuit having star connected three phase load. **(8)**