Code: DE71   **Subject: POWER ELECTRONICS**

DiplETE – ET

Time: 3 Hours	**DECEMBER 2012**	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. As compared to a PN Junction Diode, a schottky diode has _____

   (A) lower cut in voltage and lower reverse saturation current.
   (B) higher cut in voltage and higher reverse saturation current.
   (C) lower cut in voltage and higher reverse saturation current.
   (D) higher cut in voltage and lower reverse saturation current.

b. As compared to BJT, MOSFET has _____

   (A) lower switching losses and higher conduction losses.
   (B) higher switching losses and higher conduction losses.
   (C) higher switching losses and lower conduction losses.
   (D) lower switching losses and lower conduction losses.
   .
c. The gate current required to turn on an SCR is _____.

   (A) few amperes.   **(B)** a few mA.
   (C) almost equal to anode current.   **(D)** about 50% of anode current.

d. A single phase half-wave controlled rectifier circuit has an R-L load and a freewheeling diode is also in the circuit. When freewheeling diode is conducting then the SCR is _____

   (A) forward biased.
   (B) reverse biased.
   (C) both forward biased and reverse biased.
   (D) forward biased initially but reverse biased afterwards.

e. A 3 phase fully controlled bridge converter is fed by a 3- phase system having phase voltage $V = V_m \sin \omega t$ and the firing angle is α. The dc output voltage is _____

(A) $V_{dc} = \dfrac{3\sqrt{3}}{\pi} V_m \cos\alpha$.

(B) $V_{dc} = \dfrac{3V_m}{\pi} \cos\alpha$.

(C) $V_{dc} = \dfrac{\sqrt{3}V_m}{\pi} \cos\alpha$.

(D) $V_{dc} = \dfrac{3\sqrt{3}}{2\pi} V_m \cos\alpha$.

f. The chopper circuit which operates in all the Four quadrants is _____.

(A) Class A   (B) Class C
(C) Class D   (D) Class E

g. 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

h. Inverters find applications in _____

(A) HVDC transmission.   (B) UPS.
(C) Variable speed AC drives.   (D) all of these

i. When a thyristor is conducting, the voltage drop across it is about_____

(A) 1V   (B) 10V
(C) 100V   (D) 0.1V

j. In cycloconvertes, it is possible to vary_____

(A) only output frequency.
(B) only output voltage.
(C) both output voltage and output frequency, but not simultaneously.
(D) both output voltage and output frequency simultaneously.

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

Q.2 a. What is Power Electronics? What is its necessity and discuss its various applications.   **(7)**

     b. What is the advantage of two series connected power diodes with reverse bias? Draw its circuit diagram and explain its V-I characteristics.   **(9)**

Q.3 a. Draw and explain the input and output characteristics of Power Bipolar Junction Transistor. **(8)**

     b. What is the role of UJT & MOSFETs in triggering mechanism of Power Controlled Circuits? **(8)**

Q.4 a. List different thyristor turn-off methods and explain impulse commutation method. **(8)**

     b. Draw the Circuit of TRIAC and explain its operation with the help of V-I characteristics. **(8)**

Q.5 a. Draw the circuit of Single Phase Full Wave Controlled Bridge Rectifier with RL load and briefly explain its working. **(10)**

     b. A full-wave bridge rectifier with a freewheeling diode supplies an RL load. The source voltage is 120V and the resistive portion of the load is 10Ω. If the delay angle $\alpha = 30^{\circ}$, find
        (i) The average load voltage
        (ii) The average load current
        (iii) The maximum load current
        (iv) The RMS load current
        (v) The average current in each SCR
        (vi) The power supplied to the load **(6)**

Q.6 a. Draw the circuit of Three-Phase Half-wave controlled Rectifier and briefly explain its working. **(10)**

     b. A 3-Phase Six Pulse Full-Wave Controlled bridge rectifier supplies a highly inductive load and the average load current is $I_{DC} = 90A$. Ripple Current is negligible. Determine (i) The average diode current (ii) the RMS diode current and (iii) the PIV rating of diode, if the line to neutral supply Voltage is 110V, 50 HZ. **(6)**

Q.7 a. Draw the circuit of a Buck-Boost Regulator and explain its working with the help of waveforms. **(8)**

     b. What are the different types of chopper configurations? Briefly discuss type E chopper. **(8)**

Q.8 a. Draw the circuit diagram of single phase- full bridge inverter and briefly explain its working. **(9)**

     b. Write short notes on Ideal Current Source Inverter. **(7)**

Q.9 a. Describe the operating principle of three phase to single phase step up cycloconverter with the help of suitable diagrams. **(9)**

     b. What is a Static Switch? What are its various types? What are the advantages of static switches over mechanical switches? **(7)**