Subject: POWER ELECTRONICS

Time: 3 Hours **Max. Marks: 100**

JUNE 2011

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 _____ is a commonly used device in power electronics.

(A) PIN Diode **(B)** UJT
(C) PV Cell **(D)** SCR.

b. A power MOSFET is a _____ controlled device.

(A) Current **(B)** Frequency
(C) Power factor **(D)** Voltage.

c. An inverter is:

(A) AC to DC converter **(B)** AC to AC converter
(C) DC to DC converter **(D)** DC to AC converter.

d. The DIAC is primarily used as:

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

e. The static switches are of the following types:

(A) Only the AC switches
(B) Only the DC switches
(C) The electro-mechanical AC and DC switches
(D) AC and DC switches for low and high power applications.

f. The gating signals for thyristors of AC-DC converters requires:

(A) Pulse shaping to generate short duration pulses
(B) Detecting zero crossing of the input voltage.
(C) Phase shifting of signals
(D) All of the above.

g. Optocouplers are:

(A) Pulse transformers **(B)** AC voltage converters
(C) Fast switching thyristors **(D)** Commutation capacitors.

h. The choppers are commonly used as:

(A) DC transformers **(B)** Voltage regulators
(C) Harmonics generators **(D)** Frequency controllers.

i. The commonly used device for protection against transient over voltages is:

(A) Schottky diode **(B)** Selenium diode
(C) Bipolar junction transistor **(D)** Heat sink.

j. For series and parallel operation of thyristors, the preferred approach is to:

(A) Use a common heat sink
(B) Connect a small resistance in series with each thyristor
(C) Use magnetically coupled inductors
(D) Provide voltage and current sharing networks to protect them under steady-state and transient conditions.

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

Q.2 a. With the help of circuit diagrams explain gate turn-off and gate turn-on of a thyristor. **(4+4)**

b. Discuss the methods of thyristor protection. **(8)**

Q.3 a. What is the role of UJT and MOSFETs in triggering mechanism of power controlled circuits? **(8)**

b. Explain the commonly used cooling arrangements for high power devices. What are the merits and demerits of water and air cooled systems? **(8)**

Q.4 Write notes on the following:

(i) Light Activated SCR,
(ii) Thyristor Commutation.

Give diagrams, schematics and operational characteristics. **(8+8)**

Q.5 a. Compare the working of full wave controlled centre tap rectifier with full wave controlled bridge rectifier with the help of circuit explanation. **(8)**

b. Why is the power factor of semi-converters better than that of full-converters? **(8)**

Q.6 a. With the help of diagram, explain the working principle of Full-wave Half controlled Bridge Rectifiers with FWD. **(8)**

b. Using block/schematic diagram explain working of a half-wave three pulse controlled rectifier. **(8)**

Q.7 With the help of diagram / circuit explain the working of following:-

(i) Buck-Boost chopper.
(ii) Step down chopper. **(8+8)**

Q.8 a. What is the principle of operation of an inverter? Give its performance parameters? **(6+4)**

b. What are the advantages and disadvantages of current-source inverters? **(6)**

Q.9 'Static and mechanical switches, Cycloconverters and Controlled rectifiers are used in Power Electronics' --- justify this statement by giving examples, their operating characteristics and their typical utility in industrial applications. **(6+10)**