Code: D-22   **Subject: INDUSTRIAL ELECTRONICS**
Time: 3 Hours   **June 2006**   **Max. Marks: 100**

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.**
• **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 best alternative in the following:**   **(2x10)**

a. To turn off an SCR it is necessary to reduce its current to less than_____.

   (A) Trigger current.   **(B)** Holding current.
   (C) Break over current.   **(D)** Latching current.

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

   (A) Inductive.   **(B)** Resistive.
   (C) Capacitive.   **(D)** Both resistive and capacitive.

c. The commutation method in an inverter is_____.

   (A) Line commutation.   **(B)** Forced commutation.
   (C) Line & forced commutation.   **(D)** None of the above.

d. In load commutated chopper, the commutating element_____.

   (A) is a capacitor.
   (B) is a capacitor and inductor.
   (C) is a capacitor, inductor and auxiliary thyristor.
   (D) any of the above depending on load.

e. The power factor at the input terminals of a cycloconverter is_____.

   (A) Low and leading.   **(B)** Low and lagging.
   (C) High and leading.   **(D)** High and lagging.

f. The number of gates in an SCR are_____.

   (A) 2.   **(B)** 3.
   (C) 4.   **(D)** 6.

g. In a series inverter supplying a load resistance R, the commutating elements L and C should satisfy the relation_____.

(A) $R^2 = 4L/C.$ (B) $R^2 < 4L/C.$

(C) $R^2 > 4L/C.$ (D) $R^2 < 2L/C.$

h. Which of the following heating method is based on the transformer principle?

(A) Resistance heating   (B) Eddy current heating

(C) Induction heating   (D) Dielectric heating

i. Welding is not done directly from the supply mains because

(A) It is customary to use welding machines.
(B) Its voltage is too high.
(C) Its voltage keeps fluctuating.
(D) It is impracticable to draw heavy currents.

j. A cycloconverter is

(A) AC-DC converter.   (B) DC-AC converter.

(C) DC-DC converter.   (D) AC-AC converter.

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

Q.2   a. Explain the two transistor model of an SCR with a suitable circuit diagram.   **(8)**

      b. Explain the various voltage and current ratings of an SCR.   **(8)**

Q.3   a. Explain dv/dt, gate, voltage and resistance triggering of an SCR.   **(8)**

      b. Explain with the help of a circuit diagram and waveforms the operation of a single – phase half wave converter with R L load and with free wheeling diode.
       (8)

Q.4   a. Explain the principle of operation and applications of single-phase cycloconverter.   **(8)**

      b. A single-phase half-wave rectifier circuit uses a centre-tapped transformer whose output voltage

from centre tapping to outside terminal has an rms value of 150V. It feeds a load having a resistance of 30Ω. If the firing angle is $45°$, find the average dc voltage, rms load voltage, average load current and rms load current.

(8)

Q.5 a. Explain the working of a series and parallel inverter.   **(4+4)**

   b.   With the help of suitable circuit diagram and waveforms explain a three-phase inverter.
        (8)

Q.6 a. Explain the principle of operation of a chopper and give a few applications.   **(5+3)**

   b. A single-phase bridge inverter supplies power to a series connected RLC load having $R = 2\Omega$ and inductive reactance equal to 10Ω at the operating frequency of 4 kHz. The turn-off time of thyristor is 12 μ seconds. Assume 50% tolerance in circuit turn-off time. Find the value of C for proper load commutation.   **(8)**

Q.7 a. Give the different commutation circuits of a chopper.   **(8)**

   b.   Explain the principle of induction heating and give its advantages over other types of heating.   **(4+4)**

Q.8 a. Explain the process of resistance welding.   **(8)**

   b. Give a few applications of both induction and dielectric heating.   **(4+4)**

Q.9 a. Explain how thermal loss occurs in dielectric heating.   **(5)**

   b. Give the applications of resistance welding.   **(4)**

   c. Explain the basic circuits of resistance welding.   **(7)**