Code: D-22 **Subject: INDUSTRIAL ELECTRONICS**

December 2005

Time: 3 Hours

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. The gate lead, in a thyristor is welded to

(A) p layer to which anode is connected.
(B) n layer nearest to the anode.
(C) p layer nearest to the cathode terminal.
(D) Outside n layer that is nearest to the anode.

b. When an SCR is reversed biased

(A) Two junctions are reverse biased and one junction is forward biased.
(B) All the three junctions are reverse biased.
(C) One junction is reverse biased and two junctions are forward biased.
(D) Any of the above depending on the magnitude of reverse bias.

c. A single-phase full bridge inverter for R-L loads needs

(A) 4 thyristors. **(B)** 4 thyristors and 4 diodes.
(C) 4 thyristors and 2 diodes. **(D)** 8 thyristors.

d. In a 3-phase bridge inverter, the gating signals for the three phases have a difference of

(A) 120°. **(B)** 60°.
(C) 240°. **(D)** 360°.

e. The efficiency of a chopper circuit is about

(A) 80% or more. **(B)** Around 50%.
(C) Around 20%. **(D)** Around 5%.

f. The chopper circuit which uses a saturable reactor is

(A) Auxiliary commutated **(B)** Jones chopper
(C) Morgan's chopper **(D)** Load commutated

g. Thyristors can be used for control of

(A) DC separately excited motor. **(B)** DC shunt motor.
(C) DC series motor. **(D)** All of the above motors.

h. In dielectric heating the thyristor circuits that are involved are

(A) Rectifier chopper combination. **(B)** Controlled rectifier.
(C) AC regulator. **(D)** Rectifier inverter combination.

i. Induction heating is used for

(A) Melting. **(B)** Annealing.
(C) Forging. **(D)** For all the above purposes.

j. A single-phase fully controlled bridge converter can operate in

(A) 4 quadrants. **(B)** 3 quadrants.
(C) 2 quadrants. **(D)** 1 quadrant.

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

Q.2 a. Explain series and parallel operation of SCR's with suitable circuit diagrams. **(5+5)**

b. Explain UJT triggering circuit for an SCR. **(6)**

Q.3 a. Draw the waveforms of a three phase fully controlled rectifier. Explain its operation with a circuit diagram. **(8)**

b. A fully controlled 3-phase bridge rectifier circuit supplies power to a dc motor. AC line current is 200 A, ac line-to-line voltage is 400 V. If the dc voltage is 360 V, find (i) firing angle of thyristor, (ii) apparent active and reactive power, (iii) variation in firing angle necessary to maintain constant dc output voltage if the ac line voltage has a variation of $\pm 10\%$. **(8)**

Q.4 a. With the help of a circuit diagram and waveforms, explain the operation of a single-phase half bridge inverter.

(6)

b. A single-phase half bridge inverter has a resistive load of 3 Ω. The dc input voltage V is 30 V. Find (i) rms value of fundamental component of output voltage (ii) output power (iii) peak current in each thyristor (iv) average current of each thyristor (v) peak reverse blocking voltage. **(10)**

Q.5 a. Explain the basic principle of a chopper. Give a few applications of choppers. **(4+2)**

b. Explain the different commutation methods for choppers. **(5+5)**

Q.6 a. Explain the principle of induction heating and also give a few applications of the same. **(5+3)**

b. Explain what is resistance welding. Mention a few applications of resistance welding. **(5+3)**

Q.7 a. Explain the circuit of a single-phase half wave converter with R L load and with free wheeling diode. Also draw the waveforms. **(10)**

b. Explain temperature and light triggering of an SCR. **(6)**

Q.8 a. Explain the process of dielectric heating giving a few applications. What is thermal loss as applied to this type of heaters. **(10)**

b. Why is induction heating more advantageous? **(6)**

Q.9 Write short notes on:-

(i) Turn-off circuits in inverters. **(8)**
(ii) Jones and Morgan's choppers. **(8)**