

DipLETE – ET (OLD SCHEME)

Code: DE22

Time: 3 Hou

JUNE 2009

Subject: INDUSTRIAL ELECTRONICS

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 the best alternative in the following: (2 × 10)

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.

b. When an SCR is reversed biased

- (A) Two junctions are reversed biased and one junction is forward biased.
- (B) All the three junctions are reversed biased.
- (C) One junction is reversed 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. Which chopper circuit uses saturable reactor.

- (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 the above motors.
- h. In dielectric heating the thyristor circuits of
- (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. The main application of a cycloconverter is found in
- (A) Traction.
 (B) Speed control of synchronous motors.
 (C) Speed control of D.C. motors.
 (D) Lifts & hoists.

**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 single - phase half wave rectifier with R-L load and with freewheeling diode. Explain its operation with a circuit diagram. (8)
- b. A fully controlled 3- phase bridge rectifier circuit supplies a DC motor. AC line current is 200 A, AC line to line voltage is 400 V, DC voltage 360 V. Find (a) firing angle, (b) apparent active and reactive power, (c) variation in firing angle necessary to maintain constant dc output voltage if 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 $3\ \Omega$. The DC input voltage V is 30V. Find (a) rms value of fundamental component of output voltage (b) output power (c) peak current in each thyristor (d) average current of each thyristor (e) peak reverse blocking voltage. (10)
- Q.5** a. Explain the different commutation methods for choppers. (5+5)
- b. Explain how the chopper works chopper? Give a few applications of choppers. (6)
- Q.6** a. Explain the different turn off circuits of a thyristor. (8)
- b. A piece is $10 \times 10 \times 3$ cm. A frequency of 20 megacycles is used and power absorbed is 400 watts. Calculate the

voltage necessary for heating and the current that flows in the material. Piece of an insulating material is to be heated by dielectric heating. The size of the material has a relative permittivity of 5 and a power factor of 0.05.

(8)

Q.7 a. Explain what is thermal loss in dielectric heating. **(5)**

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

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

Q.8 a. How is the process of dielectric heating carried out? Enumerate a few of the uses of dielectric heating. **(8)**

b. Why induction heating is preferred over other types of heating? Where all it is used? **(8)**

Q.9 Write short notes on:-

(i) Turn off circuits in inverters. **(8)**

(ii) single-phase cycloconverter. **(8)**