[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2125)

15110

B. Tech 4th Semester Examination

Power Electronics (OS)

EE-4004

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

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question from each of the section A, B, C and D and all the subparts of the question in Section E.

SECTION - A

1. (a) What is meant by ratings and protections of thyristors? Discuss different ratings and protection schemes of an SCR. (10)

   (b) Latching current for an SCR inserted in between a dc voltage source of 200 V and load is 100 mA. Calculate the minimum width of gate-pulse current required to turn on this SCR in case load consists of 0.2 H inductance. (10)

2, What are the main features of firing circuits? Give detailed explanations of the resistance firing circuit. What are its advantages and limitations? (20)

SECTION - B

3. (a) What is an ac voltage controller? List some of its industrial applications. Enumerate its merits and demerits. (10)

[P.T.O.]

   (b) A single phase voltage controller feeds power to a resistive load of 3 ohms from 230 V, 50 Hz source. Calculate the maximum values of average and rms thyristor's currents for any firing angle α. (10)

4. (a) A single phase half wave SCR circuit feeds power to a resistive load. Draw waveforms for source voltage, load voltage, load current and voltage across the SCR for a given firing angle α. Hence obtain expressions for average and rms load voltages in terms of source voltage and firing angle. (10)

   (b) A single-phase full converter feeds power to RLE load with R=6 ohms, L=6 mH and E = 60 V. The ac source voltage is 230 V, 50 Hz. For continuous conduction, find the average value of load current for a firing angle delay of 50° (10)

SECTION - C

5. (a) What are line commutated inverters? How do they operate? Explain the difference between line commutated and force commutated inverters. (10)

   (b) A single -phase full bridge inverter is connected to an R.L. Load. For a dc source voltage of V_s, and output frequency f=1/T, obtain expressions for load current as a function of time for the first two half cycles of the output voltage. (10)

6. (a) Explain the mechanism of operation of a thyristorised three phase half bridge inverter. (10)

   (b) How does a three-phase series inverter function? (10)

SECTION - D

7. (a) Discuss the principle of dc chopper operation. Derive an expression for its average dc output voltage. (10)

   (b) A dc battery is charged from a constant dc source of 220 V through chopper. The dc battery is to be charged from its internal emf of 90 V to 122 V. The battery has internal resistance of 1 ohm. For a constant charging current of 10 A, compute the range of duty cycle. (10)

8. (a) What is a cycloconverter? Enumerate some of its industrial applications. (10)

   (b) What is the difference between the operation of the three phase three pulse cycloconverter with R load and RL load? (10)

SECTION - E

9. Answer the following questions.

   (a) State the functions of the gate of a thyristor.

   (b) Write the expression of output voltage for a single phase voltage regulator.

   (c) For 3-phase full wave converter, write the expression for its output voltage in terms of supply voltage, source inductance , load current etc.

   (d) What is the function of snubber circuit connected across SCR?

   (e) What is the sequence of the total number of SCRs conducting simultaneously in a 3-phase full converter with overlap considered?

   (f) A single phase bridge inverter delivers power to a series connected RLC load with R=2 ohms, ωL=8 ohms. For this inverter load combination what is the magnitude of $1/\omega$C in ohms for the load commutation to occur?

   (g) In single phase modulation of PWM inverters, what is the value of pulse width in degrees so that third harmonic can be eliminated?

   (h) How many thyristors are required for single-phase to single-phase cycloconverter of the mid-point type?

   (i) In dc choppers, if Ton is the on-period and f is the chopping frequency, and input voltage is Vs. Then write the expression for output voltage?

   (j) When anode is positive with respect to cathode in an SCR, the number of blocked. P-N junctions is..... (2×10=20)